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IDENTIFICATION OF OIL SLICKS BY INFRARED SPECTROSCOPY.(U)

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IDENTIFICATION OF OIL SLICKS BY INFRARED SPECTROSCOPY

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Under contract to:
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Avery Point
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Final Report

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16. Abstract

This investigation

An investigation was undertaken by the University of Rhode Island to evaluate the applicability of infrared spectroscopy to identify sources of oil spills, using computer methods for matching spectra.

Eighty-five different oils of all types were "weathered" for two weeks in at least two of four weathering grids. Two of the grids were located on Narragansett Bay (one in the Bay and one on-shore), and two at the Kingston laboratory (one inside, and one on the roof).

University's

Spectral data on approximately 900 weathered oil samples were digitized and stored in computer data files to form a library of weathered oils. These were then compared to some 300 spectra of their unweathered sources by a computer ratio method.

The investigation showed that infrared spectroscopy coupled with computer analysis is a useful technique for identifying the source of spilled oil. By using artificial weathering techniques, the correct source of a spill can be identified by infrared with a high probability when samples are collected within one week of the original spill.

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METRIC CONVERSION FACTORS

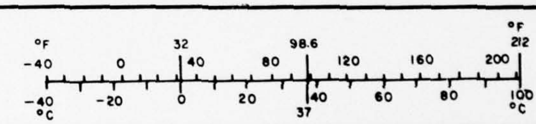
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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Finally, we are indebted to many at the University of Rhode Island for help and advice. We wish to thank Carl D. Baer for his invaluable help on all phases of this research and specifically for his contribution to the pattern recognition techniques. We also acknowledge the URI Computer Science Center and the Graduate School of Oceanography for special considerations shown to us.

SUMMARY

This investigation was undertaken to evaluate the applicability of infrared spectroscopy to identify the source of oil spills. In some spill cases, many suspects may be involved; therefore, one of the major goals of the research was to develop computer methods for matching spectra.

Initially, sufficiently large samples of all types of petroleum including lights through heavy crudes, all grades of fuel oils and lubricating oils were collected. Spectra of all these samples were measured and % transmission for 18 selected bands and for the baseline were stored in computer files to form a data bank for unweathered oils.

Eighty-five different oils of all types were "weathered" for two weeks in at least two of four possible weathering grids. Two of these grids were located at Narragansett Bay; one in the Bay and one on-shore, 100' from the Bay. The other two grids were located at our laboratory; one inside and the other on the roof of the laboratory. A number of repetitive weathering cycles were performed at each of the grids in order to determine effects of weathering under different conditions. In general, we found that the water temperature has the greatest influence upon the spectra; spectra of oils weathered at low temperatures change much less than those of the same oils weathered at warmer temperatures.

Spectral data on approximately 900 weathered oil samples were also digitized and stored in computer data files

to form a library of weathered oils. The weathered oils were then compared to their unweathered source oils by a ratio method developed previously.

The spectra of a number of oils changed considerably during the first two days of weathering but, after that the changes were generally very small. For example, the spectrum of an oil weathered two days would not compare well with that of its unweathered source; however, the spectrum of an oil weathered one week compares very favorably with that of an oil weathered two days. Thus, it was not always possible to obtain a good match of the spectrum of a weathered oil with that of its unweathered source but a good match would be obtained if both samples had been weathered.

Weathering suspect source oils under natural conditions requires considerable effort and time. Thus, we investigated methods for rapid artificial weathering. Many of the spectra of naturally weathered oil suggest that the greatest change during the first two days of weathering is due to evaporation and dissolution. With this in mind we designed experiments to test methods for rapid simulation of these effects. Eventually, we found that an unweathered oil could be artificially weathered in test tubes. A small amount of oil was shaken with water at 35 C and, after removing the water, the oil was evacuated to 0.05 Torr. The entire procedure takes less than 2 hours and the method very effectively simulates initial changes during natural weathering.

In addition to the vacuum treatment, we completely explored methods for measuring spectra. Cell types,

necessary resolution and instrument sensitivity were investigated. Furthermore, we tested the feasibility of measuring infrared spectra of petroleum at 80 K.

After the experimental details for weathering oil, removing water, simulating weathering and measuring spectra were completely investigated, we used the data on unweathered and weathered petroleum to evaluate computer methods for matching spectra. A probability density function based on the ratio method was developed and tested on the weathered oils. As anticipated, spectra of oils artificially weathered by the vacuum treatment had a high frequency of matching spectra of oils weathered for a short time period.

Finally, a pattern recognition technique using correlation coefficients to define the Kth nearest neighbor was tested. Twenty-one oils were used in the test, and the method correctly identified 17, three were tied for correct identification, and one was incorrectly idenfified.

In summary, this investigation showed that infrared spectroscopy coupled with computer analysis is a viable technique for identifying the source of spilled oil. By using artificial weathering techniques, the correct source of a spill can be identified by infrared with a high probability when samples are collected within one week of the original spill.

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I. INTRODUCTION

Each year an estimated 5 to 10 million tons of oil are discharged into the oceans of the world (1). Eighty percent of this spilled oil remains in the environment, directly poisoning marine life and indirectly threatening the rest of the plant and animal environment (2). Crude and fuel oil pollution is directly responsible for death to marine organisms through contact poisoning, asphyxiation, and exposure to water soluble toxic oil fractions. Destruction of the younger forms of marine species as well as the food of higher species is also the result of oil spills. Public health hazards created by oil pollution were realized after such disasters as the wreck of the "Torrey Canyon" and the "Tampico", and after the disasters in West Falmouth, Massachusetts and in Santa Barbara, California. For example, lobsters, abalone, sea urchins, starfish, mussels, and clams were almost completely destroyed over a wide area of Baja, California after the wreck of the Tampico in 1957.

The most effective way to deal with spills is to prevent them. This requires development of better handling and loading techniques. Tanker accidents involving grounding, collisions, and structural failings are responsible for a large number of spectacular and conspicuous oil spills, but there are also less conspicuous oil spills which result from vessel deballasting and cleaning operations. While the recent use of settling and segregating techniques by tankers has reduced this source of spillage,

there are still instances where a major spill is caused by improper cleaning operations. Environmental law enforcement can be made difficult because of hit and run accidents which deposit a "mystery" oil spill, the source of which is in question. We are, therefore, presented with the problem of chemical identification of the source of the spill.

Environmentalists have developed, refined, and applied numerous source identification techniques to the problem of oil spilled in waterways and on beaches. A number of reviews (3-11) have been written which compare and evaluate various techniques. In choosing a method to detect oil pollutants, certain identification criteria must be met and specific problems overcome. For instance, if all that is required is the determination of the quantity of hydrocarbons present in a particular area, then one of the simple extraction methods followed by infrared measurement of the absorption at 2930 cm^{-1} can solve the problem.

If, however, it is necessary to trace a spill back to its source, the greater scope of the problem requires a method which gives an unambiguous identification of the oil spilled. It must allow for changes in the sample due to weathering, i.e., the effects of sun, water, air, evaporation, dissolution, agitation, and biodegradation on the oil's components. The added convenience of a method which can easily identify even the very high boiling residuums is very desirable. Portability, low cost, and ease of operation are necessities for widespread application.

Infrared spectroscopy fulfills all these requirements.

Various approaches to the use of infrared spectroscopy in oil spill source identification have been developed. They are classified as fingerprint methods because they measure and code absorption patterns of each oil sample. Since no two petroleum products produce exactly the same spectrum, these coded spectra can be used to identify an oil just as a person's fingerprint can be used to positively identify that person.

Cole(12) describes the use of infrared spectroscopy to identify slop oils in a petroleum refinery. By setting up a reference library of infrared spectra of samples obtained from all of the the refinery streams, he was able to identify slop oils recovered from refinery sewer systems and to establish the source of leaking oils.

Brown, Lynch and Ahmadjian (13 and 14) developed an infrared fingerprinting method in which the % transmission of 21 selected bands between 650 and 1200 cm^{-1} are read into a computer. The computer then calculates absorbances from these transmittance values and converts them into pseudo absorptivities by dividing by either the exact or estimated sample thickness. A reference library of known petroleum samples was set up by storing these band absorptivities for each known in a computer file.

To match a spill sample to the correct source of the spill (the "fingerprints" of which have been previously stored in the reference computer file), the % for the

background and the % transmittance for each of the 21 bands of the spill sample are read into the computer, which calculates pseudo absorptivities for the spill sample in the same manner as described for the knowns. The absorptivities for the 21 bands of the spill sample are ratioed with the absorptivities of each of the suspect sources. By determining the suspect oil which, when ratioed to the spilled oil, yields the greatest number of ratios within 10% of the average, the correct match can be made.

Bilges contain unique mixtures of marine lube and marine diesel oil with water. The exposure of these oils to the air and water in the bilges weathers the oils to a certain extent before they are pumped overboard. The Coast Guard R & D Center has found it sufficiently conclusive to overlay spectra of a bilge oilspill with suspected sources (various bilge oil samples) in order to obtain a correct match - even when the suspect vessels were fueled at the same depot (15).

Another fingerprinting method is that of Mattson (16). Using 40 different crude and residual oils, digitized infrared transmission spectra were obtained and read directly into a computer, where they were converted into units proportional to absorbance and smoothed. The spectra were then visually displayed, and eight bands were chosen for the fingerprint evaluation. The operator selected end points for integrating each band, and the integration was then done by the computer. A baseline correction was also calculated by

the computer. Finally, the computer normalized each band to the band at 1456 cm^{-1} in order to eliminate sample thickness problems. The fingerprint was then obtained for each sample by first dividing the range of band areas of each of the eight selected bands observed for all forty samples into eight equal increments. Each of these increments was then assigned an integral value from one to eight. Each spectrum was "fingerprinted" by assigning the appropriate integer to each of the eight bands giving an eight character string for the spectrum. This fingerprint code, in essence, describes the intensities of each of the eight bands.

Another infrared transmission method used to identify petroleum is not a "fingerprinting" method per se, but is considered a "ratio method." Kawahara (17) measured absorbances of bands at 720, 810, 1375, 1600, 2925 and 3050 cm^{-1} and calculated the following ratios of absorbances: 720/1375, 3050/2950, 810/1375, 810/720, 1600/1375, and 1600/720. These six ratios were used to classify an oil as a heavy residual fuel oil or as an asphalt. Spectra of eight asphalts and eight No. 6 fuel oils were measured, and a linear relationship was obtained by plotting the 810/1375 vs. 810/720 ratios. Asphalts were confined to the lower portion of the plot, whereas heavy residual oils were spread toward the higher portion. Since it was first developed, Kawahara and co-workers (18-20) have extended the method to other types of oils and made several modifications in the general method.

In the present study we have investigated the effects of weathering and new techniques for rapid weathering. Furthermore, we investigated new and modified methods for sample preparation, spectral measurement, and computer identification procedures. Although this research was primarily concerned with evaluating infrared spectroscopy for oil identification, in many cases the results of weathering and the new procedures can be applied to other instrumental methods.

II. OBJECTIVES

The purpose of this research was three-fold:

1. To determine how weathering processes affect the infrared spectroscopic identification of oil slicks.
2. To develop the sampling, sample treatment and infrared spectroscopic techniques which would allow for routine spill sample analysis by technicians.
3. To further refine the computer identification system and to test the system on all types of unweathered and weathered oils.

These goals were accomplished through the following tasks:

1. A large number of different oils were weathered under natural conditions on Narragansett Bay to generate a library of spectra of weathered oils.
2. The same oils weathered in Task 1 were simultaneously weathered on the roof of our laboratory. These oils were then compared to those oils weathered naturally on Narragansett Bay to determine if artificial roof weathering is an accurate simulation.
3. Oils were artificially weathered in the laboratory using various techniques and conditions. These oils were then compared to those oils weathered naturally on Narragansett Bay to determine the optimum conditions for artificially weathering petroleum.
4. Actual oil spills from the East and West coasts were

sampled and analyzed to provide a direct comparison to artificially weathered samples.

5. Computer programs and techniques were developed, tested, and used to trace the source of oil slicks, and to establish an extensive infrared spectroscopic and physical informational computer library on over 1000 oil samples.
6. Techniques were developed to sample and prepare weathered and unweathered oils for analysis. New and modified spectroscopic methods were tested on petroleum. Furthermore, most commercially available infrared spectrophotometers were tested to determine instrumentation resolution (and sensitivity) requirements.
7. Results were reported directly to the U. S. Coast Guard personnel through quarterly reports. Also a number of papers were presented at national meetings and published in order that the new techniques developed by this laboratory could be quickly implemented in the field (See App. IV).

Tasks 1-6 will be discussed in detail in the following section.

EXPERIMENTAL

III-A. Task 1 - Natural Weathering of Oils on Narragansett Bay

In order to fully evaluate the use of infrared spectroscopy for identifying the source of oil slicks it was necessary to examine a large variety of different oils. These included crude oils from different regions of the world and their refined products; kerosenes, No. 1, 2, 4, 5, and 6 fuels, residuums, and lubricating oils. For each of these specific oil types there are also many different grades and blends. For example, each type of lubricating oil is specifically blended for a particular application and climate and is, therefore, unique. The refinery processes of distilling, cracking, and blending can start with the same crude oil and yield a dozen different No. 6 fuels. An oil tanker's new cargo is often mixed with a previous remaining cargo giving each shipment its own particular characteristic fingerprint. The question is whether oils retain these "fingerprints" in the event of a spill and, if so, for how long can they be used to identify the source of a spill?

To understand weathering and its effect on the "fingerprints" of petroleum we constructed two outdoor, natural weathering facilities at the University of Rhode Island Graduate School of Oceanography located on

Narragansett Bay.

III-A-1. Bay Weathering Grid

The first weathering "grid" (shown in Figure 1) consisted of a 4'x20' floating dock to which 10 floating, weathering containers were attached. The dock was 40' from shore in 12' of water and accessible by a ladder from a permanent dock. Ten 55 gallon drums comprised the weathering grid. The insides of the drums were completely fiberglassed to prevent corrosion and to minimize adhesion of the oils to the sides. The exteriors were painted with marine anti-fouling paint. The drums were floated by heavy duty truck inner tubes and secured to the dock by 1/2" chain.

To allow for the exchange of sea water, four 8" slits were cut in the bottom of each drum near the edges. In addition, a series of 1" circular holes were cut across the bottom. (After the oils were sampled and centrifuged prior to analysis, ocean debris and marine organisms were evident at the bottom of the centrifuge tubes, indicating good water circulation.) Four steel eyelets were welded to the top edges of each drum to facilitate handling during cleanup operations. The height of the drums above the water surface was kept at 15" to allow maximum sunlight to reach the oil floating inside the drums. This low drum height resulted in the loss of some oils due to splashing during rough weather, but we felt any losses were outweighed by being able to take advantage of direct sunlight.

Figure 1. Floating weathering grid in Narragansett Bay

Between 25 and 200 ml of oil were placed in each drum for a particular weathering experiment. In this volume range the amount of oil did not seem to affect the overall weathering process, since after 24 to 48 hours the heavier oils tended to form into clumps similar to tar balls, negating any effects of slick thickness whereas the lighter oils were constantly being mixed and splashed by waves and wind preventing any constant slick thickness. (When the drums were removed for cleaning after each weathering experiment the entire insides of the drums showed traces of oil.) In any type of dynamic situation such as this, it is neither possible to maintain a constant slick thickness nor is it desirable, since the same forces of agitation inside the drums would also be present on the open sea.

Eight drums were used for weathering oils and a ninth drum was used as a contamination control. One clean drum was kept available at all times in the event that an actual oil spill occured in our general area. In such a case, we would obtain a sample of the unweathered oil and simultaneously weather it in the Bay grid. The actual spill and the oil weathered in the drus were sampled at the same time intervals. Since the water temperature, air temperature, wind and weather would be very similar, this provided an ideal test for the weathering grid.

A total of 37 different oils (21 crudes and 16 fuels) were weathered at this grid. Some oils were weathered for up to two months and others were weathered repeatedly during two

week weathering cycles. The resultant data are discussed in Sec. IV-B-1 of this report. All weathered oils in this task and Task 2 and 3 were sampled at 2, 7 and 14 days.

Difficulties using this weathering grid became apparent during the fall of the first year. Oil samples were being washed out of the drums within one week. The cause of the loss was due to a shift in wind direction from the southwest during the summer to the northeast during the fall. The location of the floating dock was such that the size of the waves accompanying southerly winds was greatly reduced by the permanent dock at at the URI Graduate School of Oceanography; however, waves accompanying northerly winds reached the floating dock and weathering drums with full force. The extent of the wave action was such that all of the oils were washed out from the drums.

III-A-2. Aquarium Weathering Grid

A new outdoor, natural weathering grid (Figure 2) was then constructed on land 100 feet from shore using the facilities of the Oceanography Aquarium. This grid was comprised of ten all-fiberglass containers (18"x18"x18") with a flowthrough water circulation system. Each container was completely isolated from the others. Sea water from the Bay was pumped through each container at the rate of 1/2 gal/min.. Agitation was provided by the water circulation system which directed the flow of water at an angle across

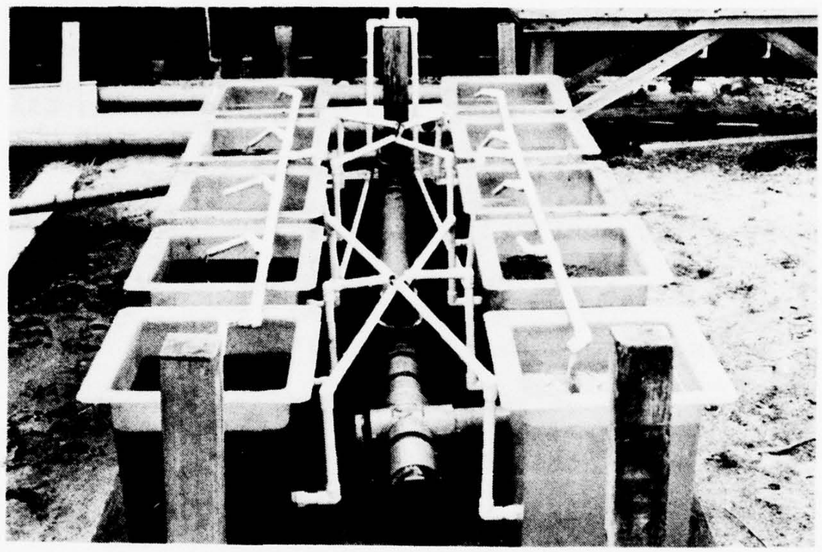

Figure 2. Outdoor weathering facility at the University of Rhode Island Graduate School of Oceanography on Narragansett Bay.

the surface and also by Bay winds blowing across the containers. The water level was adjustable, but was generally maintained 3" from the top of each container. An 800 watt thermostatically controlled submersible heater was used to maintain higher water temperature during cold weather. The effects of weathering with or without water circulation, with or without sunlight, and at different water temperatures could be easily determined with this system. In addition to the greater versatility of being able to modify weathering conditions, the time and manpower involved in maintaining and cleaning this new weathering grid was considerably less than that for the Bay grid.

A crude oil and a No. 6 fuel oil were weathered simultaneously in this new on-shore grid and in the floating weathering grid. Samples were collected at 48 hours, one week, and two weeks and subsequent infrared analysis showed that the oils weathered identically in both weathering grids.

A total of 39 different oils (8 crudes, 16 fuels and 15 lubes) were weathered in this grid. Several repetitive weatherings were performed on the same crudes and fuels. The weathering results are discussed in Sec. IV-B of this report.

III-B. Task 2 - Weathering of Oils on Roof of Laboratory

The same oils weathered at the Narragansett Bay natural weathering facilities were simultaneously weathered on the roof of our laboratory (six miles west of the Bay site). The purpose of these experiments was to determine if the Bay weathering grid was necessary for accurately weathering oil.

Ten 24x24x24" fiberglassed (over plywood) containers comprised the roof weathering grid. Fresh sea water was placed in each container at the start of every new weathering cycle. For obvious reasons there was no feasible method to provide for water circulation. Agitation was first accomplished by placing the containers on a 4'x8' platform suspended in the air by cables attached to a steel gantry. The suspension of the platform was such that it moved by the force of the wind creating small waves in each container. Later, a more forceful agitation system was employed when it was determined that the induced wind movement did not provide the necessary mixing of the oil slicks with the sea water. The paddle system described under Task 3 was used for agitation.

Due to the lack of circulating water and ocean breezes it was necessary to cool the containers during the summer and then heat them during the winter by circulating cold or hot tap water through copper coils placed in each container. Unfortunately, on warm, summer days we were unable (even with the use of a refrigerated cooling system) to maintain a roof water temperature similar to the Bay water temperature. In

fact, the water temperature would increase to 30 C during the day and cool to 20 C during the night. As a result of the higher water temperatures, the oils on the roof weathered much faster than those on the Bay.

A total of 43 different oils (21 crudes, 17 fuels and 15 lubes) were weathered using this grid. The results of this weathering are discussed in Sec. IV-B of this report.

III - C. Task 3- Laboratory Weathering of Oils

In order to develop an efficient oil slick identification procedure it is desirable to weather suspect oils to the same extent as the spilled oil. Since many laboratories do not have facilities for a natural outdoor weathering grid, we explored the feasibility of artificially weathering oils in the laboratory.

Ten all-fiberglass containers 18x18x18" were used for the weathering containers. Since the laboratory grid was located six miles from the ocean, we could not use circulating sea water. However, the 100 gallons of sea water used in these experiments were replaced at the beginning of each two week weathering period.

Agitation was provided by two methods; a mechanized paddle system and compressed air bubbled through each container. The paddle system (Figure 3) consisted of 5x7x.25" fiberglassed aluminum paddles connected by mono-filament line to the rotating arm (40 rpm) of a gear reducer, powered by a 1/3 hp electrical motor. The upward stroke of the arm pulled the paddles up and an attached weight returned the paddles to their original positions creating strong wave action in each container. Compressed air for the second agitation system was supplied by a laboratory air jet at a rate of 1.5 l/min.. The air was filtered through a cotton trap before use. Water temperature was regulated by cooling coils in each tank and wind was provided by a variable speed, electrical fan blowing across

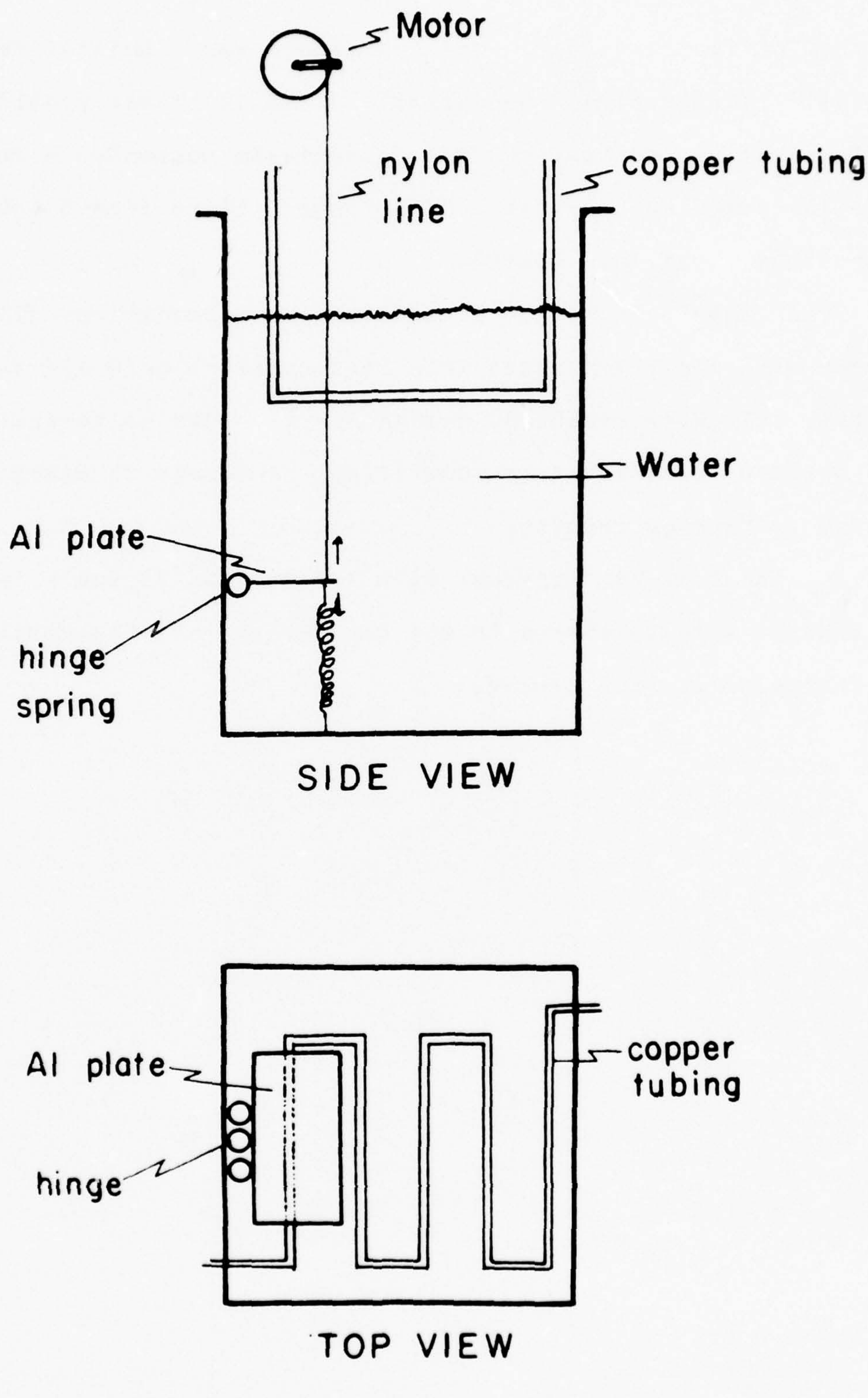

Figure 3. Schematic of in-laboratory weathering grid

the tops of the container. The containers were isolated from external illumination, and artificial sunlight was provided by four timer controlled U. V. sunlamps suspended 4 feet above the container. Varying illumination times from 0 hours to constant light were tested.

The same oils weathered under natural conditions (Task 1) were also weathered using this in-laboratory grid and many of the oils were weathered repeatedly in order to determine the optimum in-laboratory conditions necessary to simulate the Bay weathering results.

A total of 78 different oils (30 crudes, 33 fuels, and 15 lubes) were weathered in the laboratory, and the results are discussed in Sec. IV-B-2.

III-D. Task 4 - Actual Oil Spills

In order to determine the effectiveness of our man made weathering grids and to test newly developed spectroscopic and computer techniques, we analyzed as many actual spills as possible.

The most comprehensive test involved oil samples taken from the ruptured tanks of the Messeniaki Bergan and oil slick samples collected at 24 hours and six days after the tanker spilled 100,000 gallons of No. 6 fuel oil into New Haven Harbor.

The oil taken directly from the ship's tanks was weathered in the Narragansett Bay grid, in the Aquarium grid, and in the laboratory weathering grid and samples were collected at 24 hours, 48 hours, 1 week and 2 weeks for infrared and computer analysis. The results are presented in Sec. IV-B-3.

The Aquarium site was further tested by weathering Santa Barbara natural seep oils. Again the results confirmed the similarity of weathering between real and man made slicks.

Furthermore, the Coast Guard R & D Center at Groton, Conn. routinely provided real world spill cases to test the spectroscopic and computer methods which were being developed.

III-E. Task 5 - Development of Computer Assisted Identification of Oil from Infrared Spectral Data

The primary goal of this task was to develop and test computer methods for identifying the source of spilled petroleum. Due to the large number of samples it was necessary to develop the software for storage, retrieval and movement (from file to file, etc.) of informational and spectral data. The program listings and the procedures for using the programs are given in Appendix III. The programs and their purpose are given below.

III-E-1. Informational Data

PROGRAM IDENT - for storing informational data on unweathered and weathered oils.

a. Unweathered oils

   i) identification number

   ii) type of oil

   iii) company and source location

   iv) month and year received

b. Weathered oils

   i) identification number (which includes codes for location and time of weathering)

   ii) air and water temperatures

   iii) wind velocity and cloud cover

iv) sampling and analysis dates

v) conditions for laboratory weathering

(The data stored by this program and identification of the codes are given for all oils in Appendix I)

PROGRAM INFO - retrieves and displays any or all of the informational data entered into the computer files through program IDENT. It has the following printing and display options:

a. data on any particular unweathered oil

b. data on weathered samples for one particular oil

c. data on one type of oil

d. data on all unweathered oils

e. all data on all unweathered and weathered oils.

III-E-2. Spectral Data

PROGRAM TOIL - used for creating data files of spectral data including % transmission data, cell type, and pathlength. Each file contains a particular type of oil as follows:

FILE	OIL
01, 02	crudes
03	kerosenes
04	No. 2 and 4 fuels
06	No. 5 and 6 fuels

07	residuums and special oils
08	lubes
10	vacuumed oils
11, 12	weathered crudes
14	weathered No. 2 and 4 fuels
16	weathered No. 5 and 6 fuels
18	weathered lubes.

The other files were used for special cases such as actual spills, repetitive studies, and pre-treatment studies.

PROGRAM SEARCH - uses the ratio method to compare infrared spectral data of one sample with any or all of the data in any one of the files created by program TOIL. Percent transmission data for the oil can be entered during a run or they can be taken from any one of the files.

This program was modified many times during the contract and we used many different versions; however, in this report we include only the final version. This version of the program gives the number of ratios within specified limits Details of the methods used are given in Sec. IV-A and IV-E-1.

PROGRAM COCO - used for determining correlation coefficients between spectral data for one oil and those for all oils stored in one of the data files. The method and results are discussed in detail in Sec. IV-E-2.

III-F Task 6 - Sampling Techniques and Instrument Resolution

III-F-1. Sample Treatment

III-F-1-a. Removing water from oil.

Sampling of an oil spill does not present any serious difficulties; heavy oils can be collected with a spatula or by simply dipping a bottle into the water, whereas lighter oils can be collected by withdrawing the top layer of water (and oil) with a large hypodermic syringe. However, there is a problem with the samples, and that is the necessity to remove water prior to analysis.

Initially, we tried dissolving the oil in $CHCl_3$ to reduce the viscosity, centrifuging the sample to remove excess water, adding anhydrous $MgSO_4$, and centrifuging to remove the remaining water. The difficulty with this procedure is that the solvent must be removed prior to measuring spectra and this is almost as difficult as removing the water. We found it necessary to heat thin films of the samples to 70 C in order to remove all of the solvent; however, at this temperature many of the components of the oil were also removed and this changed the fingerprint of the oil.

Eventually, we (21) found that the best method for removing water was simply to centrifuge (3700 rpm) the sample

at 35-40 C for 0.5 to 2 hrs., remove the excess water, add anhydrous MgSO and centrifuge again at 35-40 C for 0.5 to 2 hrs. For light oils all of the water was removed by centrifuging for the shorter period at the lower temperature, whereas heavier oils had to be centrifuged for the longer time period at the higher temperature.

III-F-1-b. Techniques for Measuring and Coding Infrared Spectra of Unweathered and Weathered Oil Samples

i) Types of Cells-

To measure the infrared spectra of unweathered and weathered petroleum samples we explored the use of three types of cell windows, i.e., KBr, NaCl and AgCl. These three were chosen because they are the least expensive of the types available and they are transparent over much of the infrared region.

UNWEATHERED OILS. These oils generally contain only a very low percentage of water, if any measurable quantity is present. We have experienced only one or two notable exceptions to this after measuring spectra of over 250 unweathered crudes and distillate products. The absence of water allows the use of KBr and NaCl cell windows as well as

AgCl. The choice of demountable or sealed, fixed pathlength cells depends on the viscosity of the oil. Both KBr and NaCl cells are available as sealed or demountable cells, but AgCl is available only as single windows to be used in a demountable cell. Most crudes (85%), all lighter distillates and between 50-75% of the No. 4, 5, and 6 fuels can be easily injected into a sealed cell. For the more viscous fuels and heavy residuums, a demountable cell must be used. (It should be noted here that others suggest that the use of a sealed cell with the heavy cuts of oil is possible when the cell and oil are warmed. However, since heat can both weaken KBr and NaCl windows, as well as cause changes in the relative intensities of the absorption bands, we found it better to use demountable cells with these oils.)

WEATHERED OILS. As an oil weathers on the open seas, it becomes emulsified with water, the degree depending upon length of weathering. Moisture attacks both KBr and NaCl windows. Therefore, we developed a centrifuge method to remove emulsified water from oil (Sec. III-F-1-a). If water removal is complete, KBr or NaCl windows can be used. However, to monitor the efficiency of water removal prior to measuring the entire infrared spectrum, AgCl windows are used and the 3400-3600 cm^{-1} region is rapidly scanned. Also, for heavily weathered samples water cannot be completely removed since the water seems to be electrostatically bound by highly oxidized sites in the oil itself. If this is the case, again

AgCl windows must be used.

ii) Advantages and Disadvantages of Cell Types

NaCl

1. inexpensive
2. relatively easy to maintain
3. hygroscopic
4. starts to absorb below 800 cm^{-1}

KBr

1. inexpensive
2. does not absorb in fingerprint region
3. more hygroscopic than NaCl
4. more difficult to maintain

AgCl

1. water insoluble
2. does not absorb in fingerprint region
3. scratches easily
4. more difficult to maintain
5. light sensitive
6. not available as sealed cell

iii) Cell Pathlength

After measuring over 1000 spectra of unweathered and weathered oils, we have found that a pathlength at or between 0.050mm and 0.075mm gives the most accurate infrared spectra. At these pathlengths the strong bands in the fingerprint region will have a % transmission >20% and yet the weaker bands will still be detected.

iv) Conditions for Measuring Spectra

After chosing the appropriate cell window material, and spacer thickness, the cell (demountable or sealed) is prepared in the standard manner. The infrared spectrum of the oil sample is then measured between 4000 and 625 cm^{-1}. All spectra were normally measured in our lab on a Perkin-Elmer Model 521 infrared spectrometer using instrumental settings specified by the manufacturer for service type spectra. The spectra were calibrated with polystyrene.

v) Coding Spectra

Originally, in coding the spectrum between 1200 and 650 cm^{-1}, the transmittances of 21 frequencies were manually recorded (i.e., 695, 720, 725, 740, 765, 770, 780, 790, 805, 810, 820, 835, 845, 870, 890, 915, 955, 1020, 1070, 1145, 1160 cm^{-1}). These bands were chosen after many spectra of a variety of oils had been measured, since they had the greatest frequency of occurrence. However, after weathering these same oils, it was found that three bands (770, 805 and 820 cm^{-1} which were very close to adjacent bands (765 and 810), disappeared, leading to inconsistencies in coding. Therefore, because of their close proximity to adjacent bands and their disappearance upon weathering, they were dropped in the analysis. Presently, the 765 cm^{-1} band is taken as the first maximum or shoulder after the band at 740 cm^{-1} and the 810 cm^{-1} value is assigned to the strongest maximum between 805 cm^{-1} and 815 cm^{-1} .

Once the 18 transmittances are coded, they are stored

in computer files as described in Sec III-E-2 and Appendix III.

III-F-1-c. Low Temperature Spectra

For measurements of infrared spectra at 80 K, a typical low temperature infrared cell was used. A schematic of the cell in which CsI substrate and outer windows were used is shown in Figure 4. To place a sample of oil in the cell one outer window was removed, the cell held in a horizontal position, and oil deposited on the CsI substrate (alternatively, the oil can be deposited on the substrate through a ground glass joint on the side of the cell). After depositing the sample, cold gaseous N is passed into the inner chamber to cool the substrate and sample; the outer chamber is flushed with dry N gas to eliminate condensation of water. After the sample solidifies, the outer window is replaced, the outer chamber evacuated to 10^{-3} torr, the cell turned upright and the inner chamber filled with liquid N . Time required to prepare the sample cell and measure the spectrum at 80 K is approximately 45 min. Preparation of the sample and measurement of the spectrum at room temperature requires 25-30 min.

Spectra were also measured at 20 K using a Cryotip cell (Air Products, Inc.). The sample deposition procedure was similar to that used for the 80 K measurements. However, because of the long "turn-around" time, only one spectrum

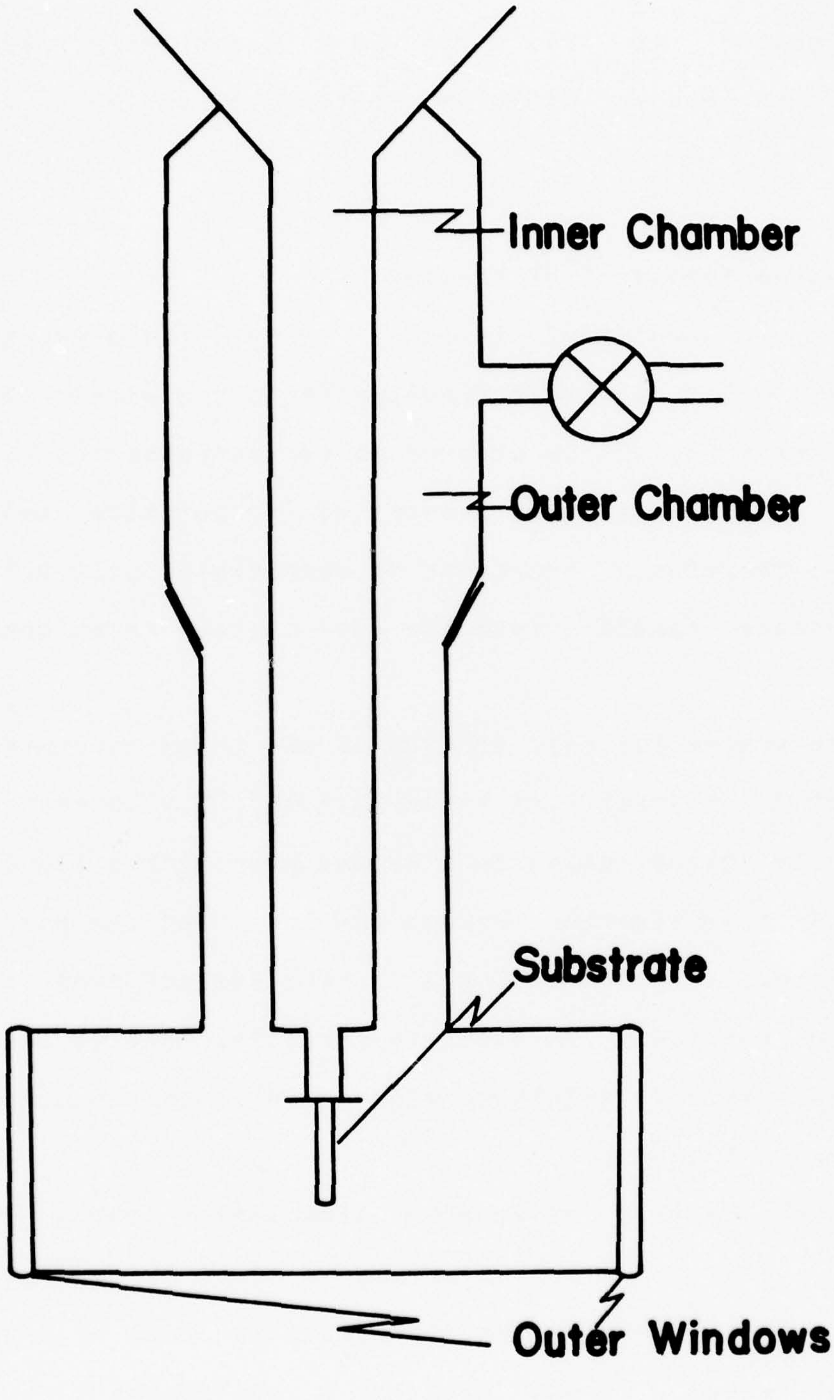

Figure 4. Typical infrared cell for measuring spectra at liquid N_2 temperature

could be measured per day. The 20 K experiments were performed only to show the difference between 80 and 20 K.

III-F-1-d. Vacuum Treatment of Samples

As will be described in Sec. IV-C-2, the greatest change in an oil's infrared fingerprint occurs within the first 48 hrs that the oil is exposed to the environment, and this change is largely the result of evaporation and dissolution. Therefore, treatment of unweathered oils with water and vacuum should cause the same changes as natural weathering.

A vacuum system for this portion of the study consisted of a series of 30 cm Pyrex test tubes (3.5 cm I.D.) connected in parallel by Tygon tubing to a vacuum pump with a liquid nitrogen cold trap inserted between the tubes and the pump. With this system, a vacuum of 5×10^{-3} torr was achieved for all evacuated samples. To evacuate the oils, samples were smeared on AgCl windows and these windows were then inserted into the Pyrex test tubes.

For those samples undergoing dissolution tests in addition to evacuation, approximately 2 ml of the oil was added to a test tube containing approximately 25 ml of warm (35-40 C) sea water. These test tubes were shaken 3 or 4 times over a period of 1.5 hours to allow for sufficient mixing of the oil and water. Water was then removed from the oil by the procedure in Sec. III-F-1-a, and the samples were

subjected to the vacuum treatment described above.

To keep samples warm during evacuation, each test tube containing a AgCl window was inserted into a hot water bath whose temperature was maintained at 35-40 C. The sample was pre-warmed in this way for 15 minutes prior to evacuation and then for the duration of the evacuation.

III-F-2. Instrument Resolution and Sensitivity

During the course of this study we measured spectra of the three A.P.I. standard oils on all possible commercial instruments. The spectrum of each oil was measured on all instruments in the same 0.05 mm KBr cell. Moreover, spectra were measured on each instrument at standard instrument conditions (i.e., those conditions specified by the manufacturers for "service type spectra").

In addition to intra-instrument comparisons, we performed a study to determine the necessary resolution needed to identify an oil. This study was a joint effort with Beckman Instrument Co. (Fullerton, Calif.), and was performed on a Beckmann Model 4240. Spectra of 12 weathered and unweathered oils were measured from 2000 to 600 cm^{-1}, and the digital intensities at each wavenumber were stored on paper tape. These data were processed using the "ratio method," and the following wavenumber increments were compared:

i) the 18 frequencies normally used

ii) every cm^{-1}

iii) every 10th cm^{-1}

iv) every 20th cm^{-1}

v) every 30th cm^{-1}

The results are presented in Sec. IV-C-1-b.

IV. RESULTS AND DISCUSSION

The results and discussion of various phases of this investigation have been written in manuscript form and are either published or submitted for publication (App. IV). In this section we will summarize and combine the results from the individual manuscripts, and discuss those results which have not been included in the manuscripts.

IV-A. Ratio Method

Analysis of all spectra and the comparisons used to determine optimum simulated weathering conditions were made using the ratio method (22) or appropriate modifications of this method. The original method is outlined in Table I. Briefly, the absorptivities of two samples are calculated from % transmissions of the bands; these are ratioed for each band, averaged over all bands, each ratio divided by the average, the new average (1.0) is subtracted from each of the modified ratios and the number of ratios within 5, 10, 25, and 50% of this average are listed by the computer.

The original computer method was written for the purpose of matching the spectrum of a weathered oil with the correct source oil, i.e., comparisons were always made for weathered with unweathered oils. However, in the present research it was also necessary to compare unweathered with weathered oils in order to to determine the effects of

TABLE I. Original Computer Searching Method

1)	Absorptivities of known calculated and stored in computer file	$a_i = \frac{A_i}{b} = \frac{1}{b} \log \frac{I_o}{I_i}$
2)	Absorptivities of unknown calculated	$a_i'' = \frac{A_i''}{b''} = \frac{1}{b''} \log \frac{I_o''}{I_i''}$
3)	Ratios of absorptivities of each known to unknown calculated at each frequency	$\frac{a_i}{a_i''} = \frac{A_i b''}{A_i'' b} = \frac{A_i}{A_i''}B$
4)	Average ratio for each known to unknown calculated	$\frac{1}{N} \sum_{i=1}^{N} (Ai/Ai'')B = \frac{B}{N} \sum_{i=1}^{N} (Ai/Ai'') = BZ$
5-a)	Ratios divided by average to make average 1.0	$\frac{A_i}{A_i''} B/BZ = \frac{A_i}{A_i'' Z}$
5-b)	Difference between ratios and 1.0 (the average) calculated	$\frac{A_i}{A_i'' Z} - 1.0 = Diff_i$
6)	Listing of the number of bands for each known with a difference (ratios-average) less than ±0.05, ±0.10, ±0.25, and ±0.5	

Definition of Terms:

a_i = absorptivity of i^{th} band

A_i = absorbance of i^{th} band

b = pathlength of cell

I_o = % transmission of background

I_i = % transmission of i^{th} band

" = values for unknown sample

B = b"/b

N = total number of ratios

$Z = \frac{1}{N} \sum_{i=1}^{N} (Ai/Ai'')$

weathering. In other words, in addition to the ratios, we also needed the reciprocal ratios. Using the original method the average ratio is made to be 1.0 (step 5-a) and we list the number of ratios within 5, 10, 25, and 50% of this average. If a particular ratio is 2.0, its reciprocal would be 0.5. The first ratio would be outside the 50% limit, whereas the second would be counted. Ideally, they both should or should not be counted, i.e., the difference between either ratio and the average should be the same.

We solved this dilemma very simply by going to a log scale. In the above example the log of 2 and the log of 0.5 are the same except for the sign. The revised method is outlined in Table II; the first three steps are the same as before, in step 3-b the log of the ratio is calculated, and rather than divide by the average we subtract the average from each log-ratio to give a new average of 0.0. In this revised method the ratios and reciprocals are identical except for sign. Furthermore, the pathlengths of both cells are still eliminated (step 5).

Another addition to the method was a plotting routine. In addition to listing the number of bands within 5, 10, etc., we also can plot the differences to give a bar-graph as shown in Figure 5. In this way we can plot the differences for an oil weathered for various lengths of time compared to the unweathered oil to determine the trends in weathering, (The plotting routine is not included with the computer programs, since the plotting "commands" can only be used at the University of Rhode Island's Computer Center.)

TABLE II. Revised Computer Searching Method*

1)	Absorptivities of known calculated	$a_i = \frac{A_i}{b} = \frac{1}{b} \log \frac{I_o}{I_i}$
2)	Absorptivities of unknown calculated	$a_i'' = \frac{A_i''}{b''} = \frac{1}{b''} \log \frac{I_o''}{I_i''}$
3-a)	Ratio of absorptivities of each known to unknown calculated at each frequency	$\frac{a_i}{a_i''} = \frac{A_i b''}{A_i'' b} = \frac{A_i}{A_i''} B$
3-b)	Log of each ratio calculated	$\log \frac{A_i B}{A_i''} = \log \frac{A_i}{A_i''} + \log B$
4)	Average log-ratio calculated	$\frac{1}{N} \sum_{i=1}^{N} (\log \frac{A_i}{A_i''} + \log B) = \frac{1}{N} \sum_{i=1}^{N} \log \frac{A_i}{A_i''} + \log B$
5)	Average log-ratio substracted from raw ratios to make average 0.0	$\log \frac{A_i}{A_i''} + \log B - \frac{1}{N} \sum_{i=1}^{N} \log \frac{A_i}{A_i''} - \log B = \text{Diff}_i$
6)	Listing of the number of bands for each known within limits of ±0.025, ±0.04, ±0.10 and ±0.15.	

*See Table I for definition of terms

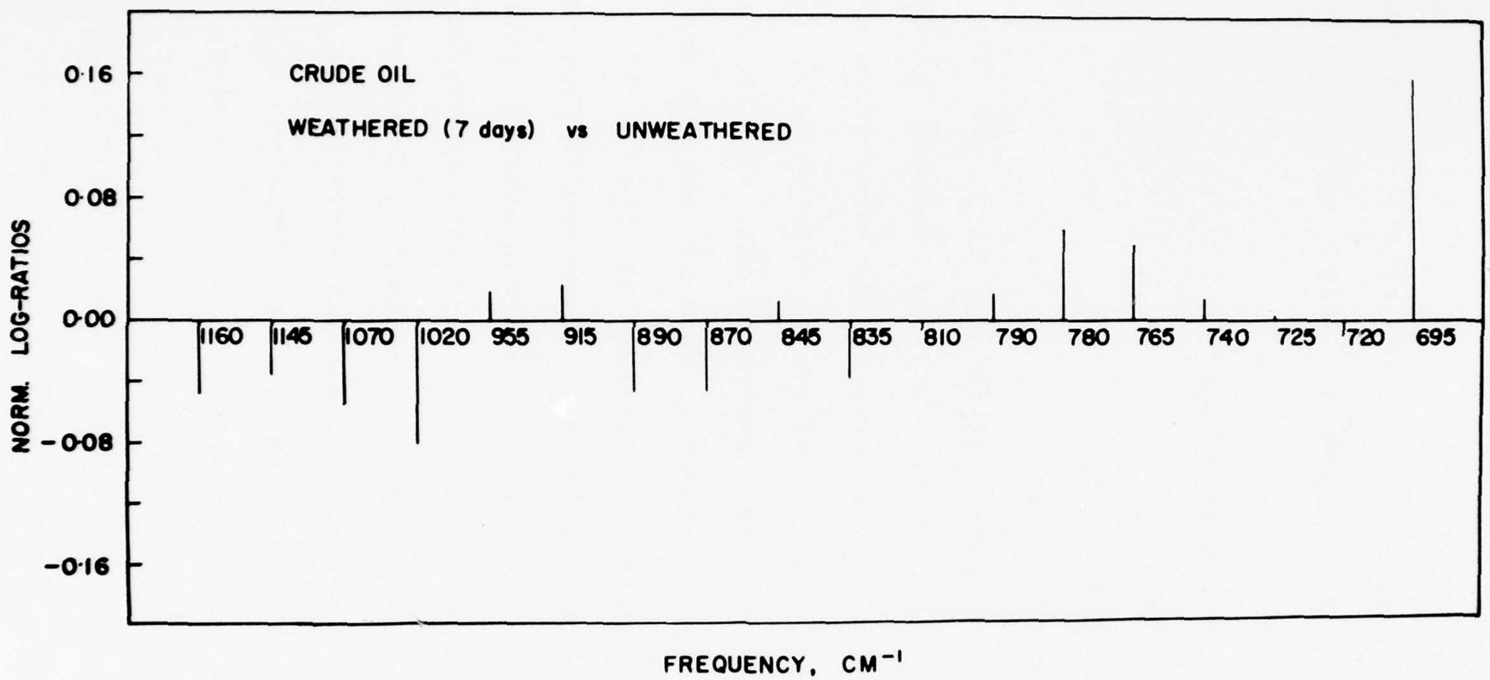

Figure 5. Histogram of the weathered versus unweathered crude (177) obtained by the log-ratio method

IV-B Natural and Simulated Weathering (22)

IV-B-1. Weathering Grids

As discussed in Sec. III-A, III-B and III-C the following four weathering grids were used in this investigation:

i) Narragansett Bay

ii) On-shore

iii) Laboratory

iv) Roof top

Initially, we used grids i, iii, and iv; thus, we will compare these first. Typical spectra of three different types of oils weathered in the three grids are compared to the original unweathered oil in Figures 6, 7, and 8. In each figure (a) is the unweathered oil, (b) the oil weathered in grid i, (c) weathered in grid iv, and (d) weathered in grid iii. The weathered samples of the crude oil were all collected after two weeks. There are differences between the spectra of the three weathered samples, since the rate of weathering was not identical in the three systems. Generally, the oils in the roof grid weathered faster than those in the Bay grid, whereas those in the laboratory grid weathered slower. Using the computer ratio method of comparison we found that ratioing the spectrum of the 1 week Bay sample to that of either the 2 day roof sample or the 2 week laboratory sample produced 18/18 ratios within 10% of the average. This is further demonstrated in Figure 7, where the spectrum for a 1 week Bay sample of No. 6 fuel is

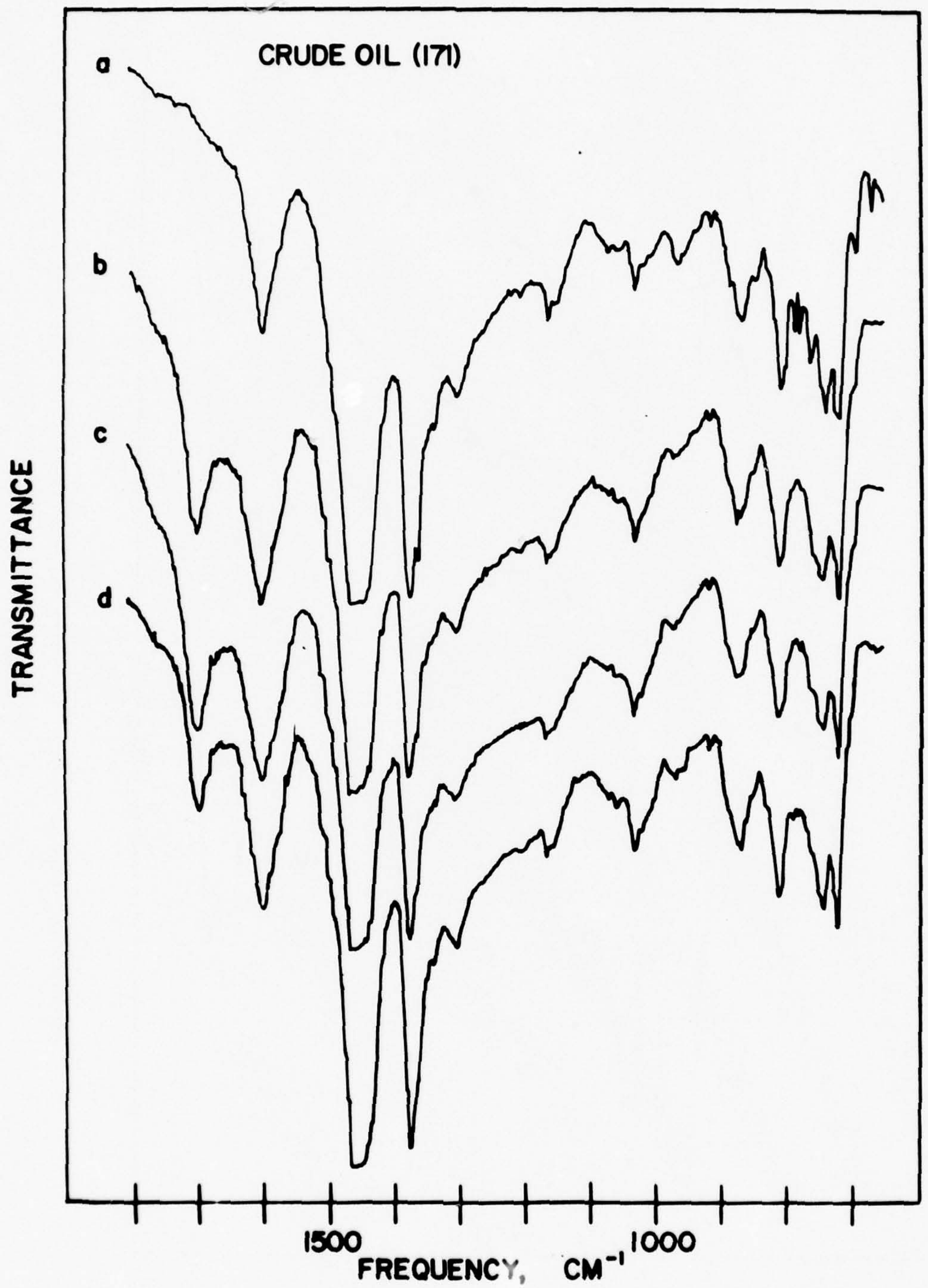

Figure 6. Infrared spectra of a crude oil: (a) unweathered; (b) weathered in Bay grid for 2 weeks; (c) weathered in roof grid for 2 weeks; and (d) weathered in laboratory grid for 2 weeks

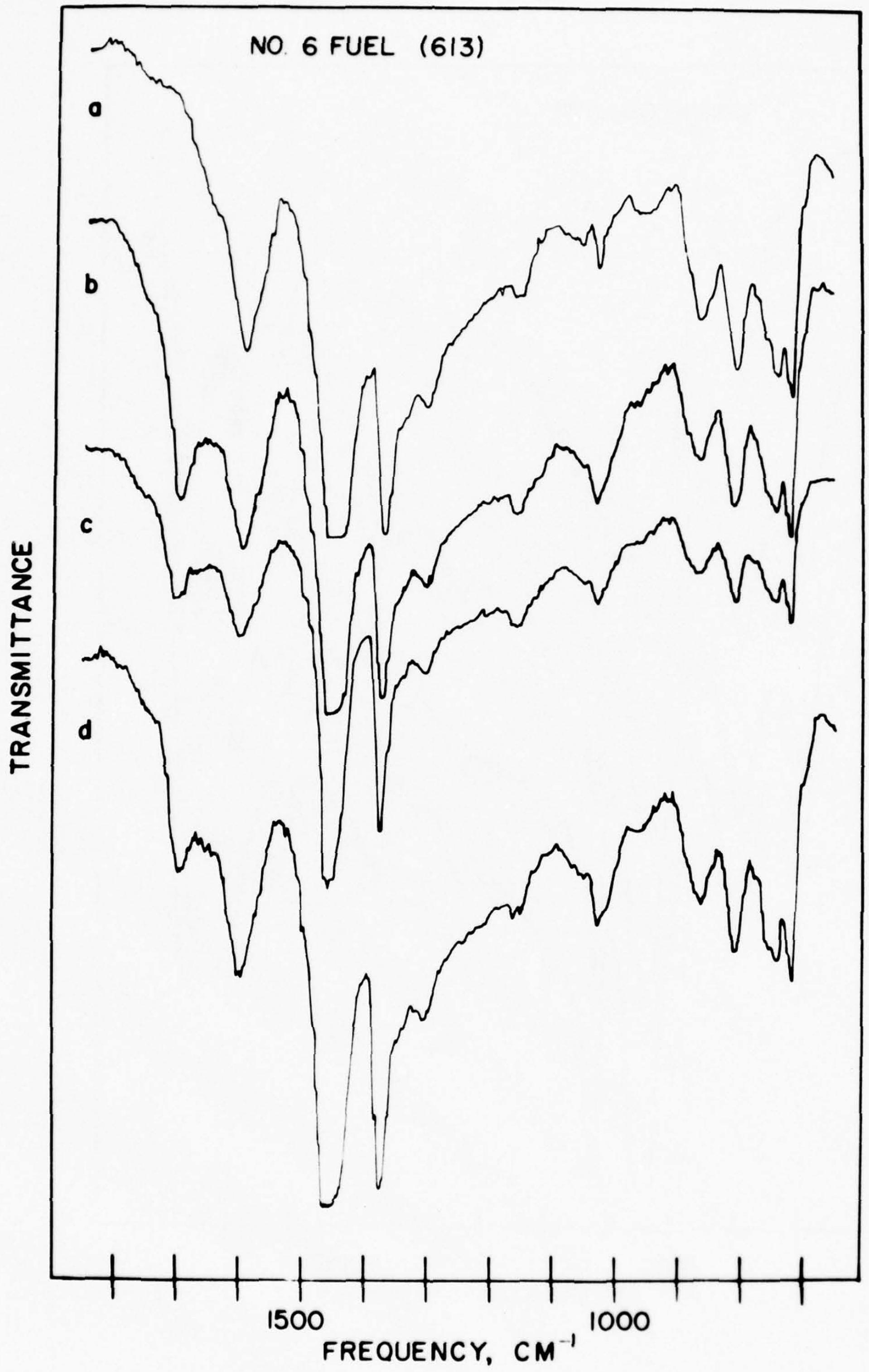

Figure 7. Infrared spectra of a No. 6 fuel oil: (a) unweathered; (b) weathered in Bay grid for 2 weeks; (c) weathered in roof grid for 2 weeks; and (d) weathered in laboratory grid for 2 weeks

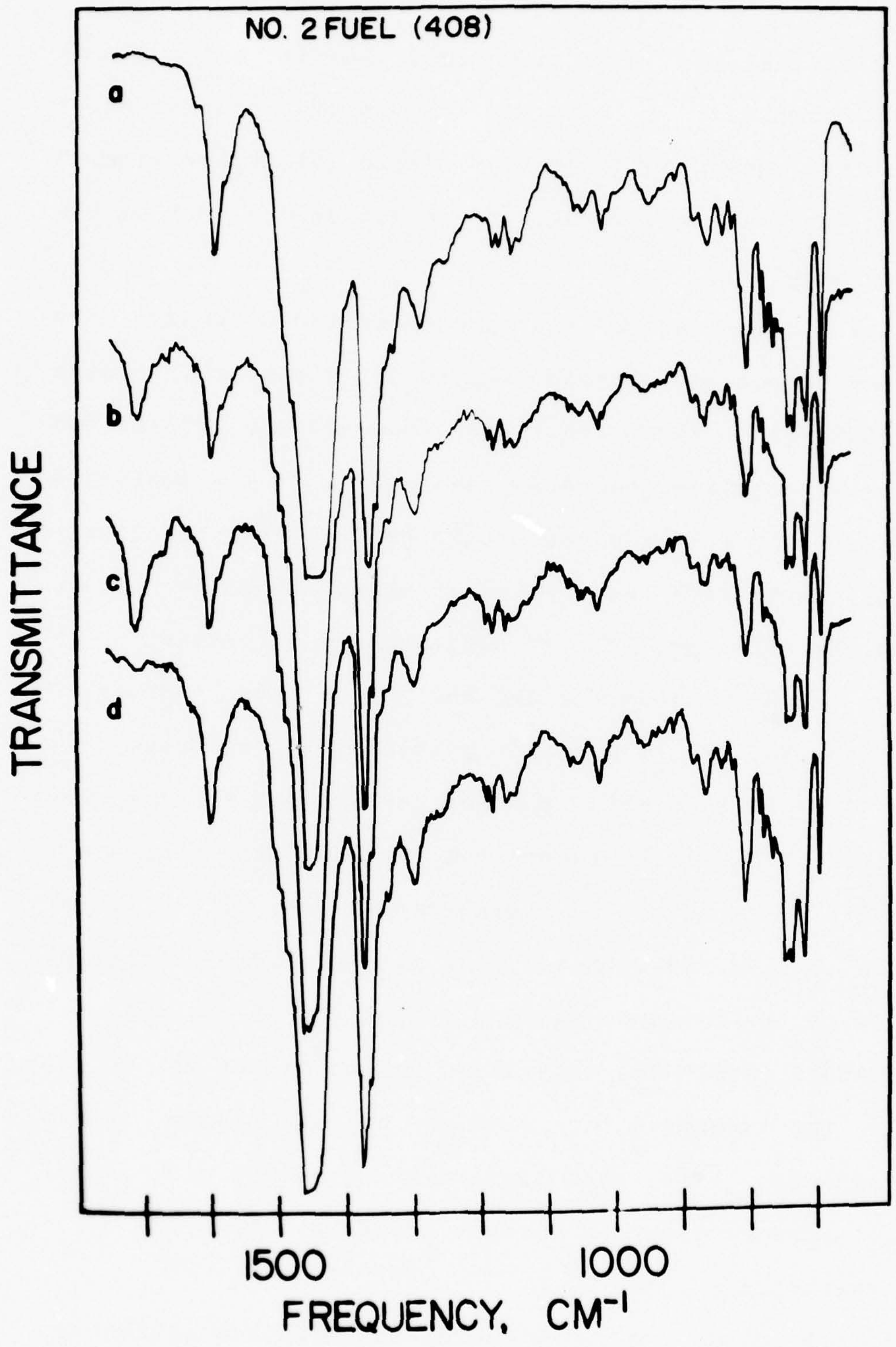

Figure 8. Infrared spectra of a No. 2 fuel oil: (a) unweathered; (b) weathered in Bay grid for 2 days; (c) weathered in roof grid for 2 days; and (d) weathered in laboratory for 2 days

compared to that of a 2 day roof sample and a 2 week laboratory sample. In this case the computer comparison of these spectra gave 17/18 ratios within 10% of the average when the Bay sample was compared to either the roof or the laboratory sample.

Visual comparison of the spectra of the weathered oils with those of the unweathered oils in the fingerprint region of 650-1200 cm^{-1} shows that the bands between 770 and 800 cm^{-1} have almost disappeared in the spectra of the weathered crude oil. These bands are undoubtedly due to light components that have evaporated or dissolved in the water. Note that the stronger, broader bands remain unchanged.

The sampling time for the No. 2 fuel (Figure 8) was 2 days. Since No. 2 fuel contains mainly light components, it is more difficult to match the weathering conditions of the three grids. This is the reason for the lack of the carbonyl band in the spectrum of the in-lab sample (d). The computer comparison of the Bay with the roof sample gave 17/18 ratios within 10% of the average, whereas comparison of the Bay with the laboratory sample had only 14/18 ratios within 10% of the average. The spectrum of a No. 2 fuel oil changes faster with weathering time than heavier oils and, in most cases, the oil disappears from the surface of water during the first week of weathering.

In all cases we were able to simulate weathering conditions in the laboratory and on the roof of the laboratory to match those of Narragansett Bay; however, as

indicated above, the rate of change is difficult to duplicate. Temperature control, amounts of agitation and illumination are critical for the simulated weathering. Due to drastically different water temperatures between night and day in the roof weathering containers, we replaced this grid with the on-shore grid.

IV-B-2. Comparison of Laboratory with Bay Weathering

Direct comparisons between oils weathered in grids i or ii were made with the same oils weathered in the laboratory (grid iii) for the same period of time. The laboratory conditions such as water temperature and amounts of artificial light and wind were varied to try to match natural conditions. Typical comparisons for selected oils are shown in Figures 9-23 for ten crudes and five No. 6 fuels. At each of the 18 frequencies used in this investigation we made (when possible) six comparisons; three for the lab (designated ▽) and three for the Bay (designated x). The first pair of comparisons (▽+ x) at each frequency is for the 2 day weathered sample with the unweathered oil, the second for the 7 day, and the third for the 14 day.

Points below 0.0 on the plots indicate an increase in absorption compared to the unweathered oil, whereas points above 0.0 indicate a decrease in absorption. Since these differences are relative to the average of 0.0, the plotted values are relative rather than absolute. In general, the absorption of bands above 900 cm^{-1} increase with weathering, whereas those below decrease. Moreover, another general trend is seen in all of the plots and that is that the largest change takes place during the first two days of weathering; after that the changes may become random.

In most of the cases shown in Figures 9-23 spectra of the Bay samples change more than those of the lab samples, although this is not true for all of the bands in all of the

comparisons. Generally, the three points for the Bay and the three for the lab at each frequency form two clusters. In many of the examples, the three point cluster for the lab and the cluster for the bay are very close, eg., 152, 172, and 178. When clusters for all of the bands are close, this generally indicates that the water temperature in the laboratory containers was very close to that of the Bay. In all of these examples we tried to match the water temperatures as closely as possible; however, since the oil film is a strong absorber of sunlight, oils weathered outside probably got warmer during the daytime.

We tried to match the illumination with sun-lamps, but this is difficult if not impossible. We varied the height of the sun lamps above the water and the number of lamps used. However, we found that the most important influence was to illuminate the oils intermittently, i.e., have some illumination each day. Therefore, the lights were controlled by a timer and were used intermittently 8-12 hrs/day, and the best comparisons with the Bay weathered oils were obtained under these conditions.

Spectra of oils weathered in the laboratory are discussed further in Sec. IV-E-2, where their use in identification is described.

In Figures 9 - 23 laboratory (▼) and Bay (X) or Aquarium (X) are compared to the unweathered oil. In each figure the first pair (▼ and X) at each frequency is for the 2 day weathered samples, the second for the 7 day, and the third for the 14 day.

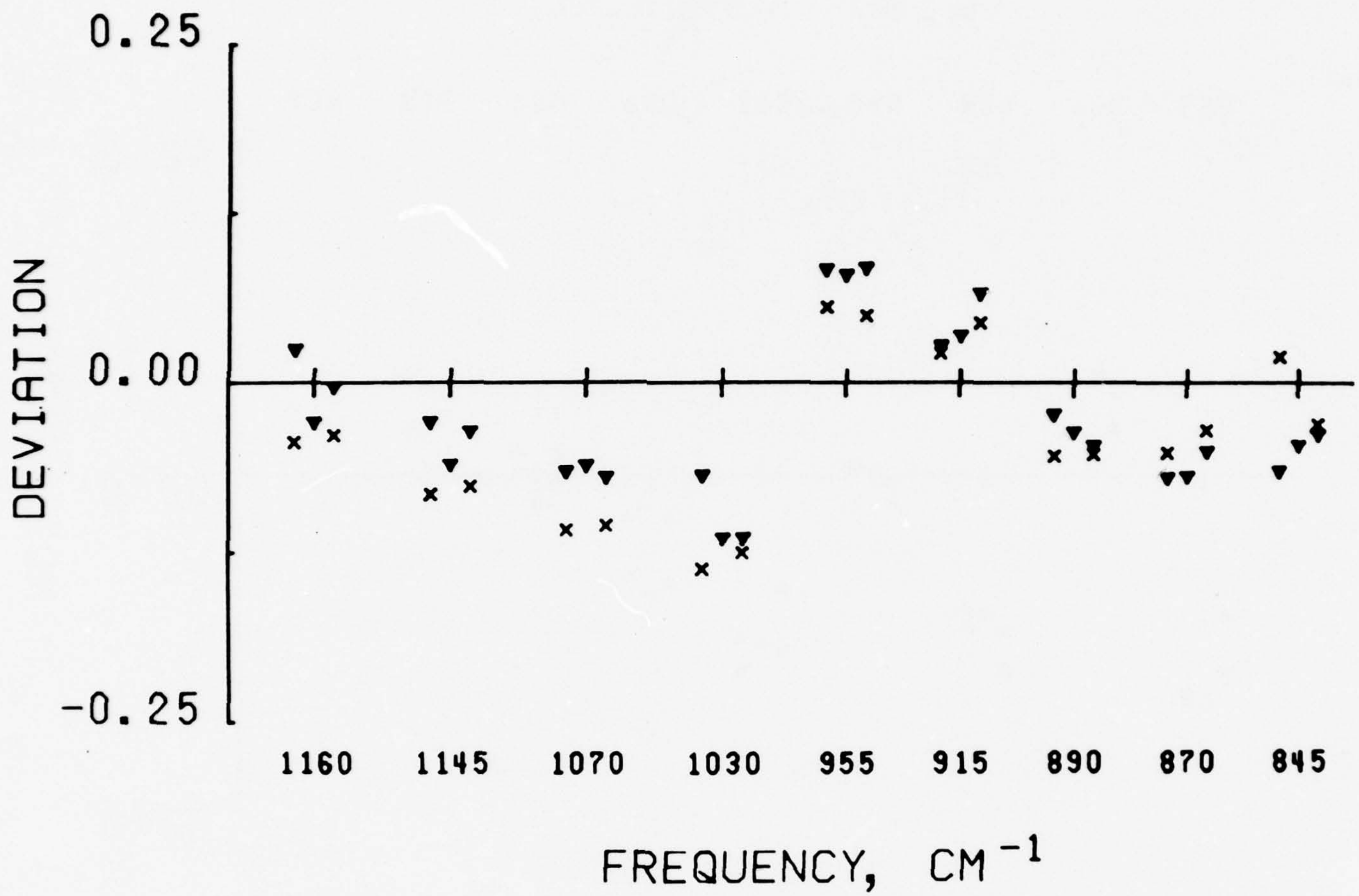

Figure 9-a. Crude 152; 152101 (X), 152103 (X), 152301 (∇), 152302 (∇), and 152303 (∇)

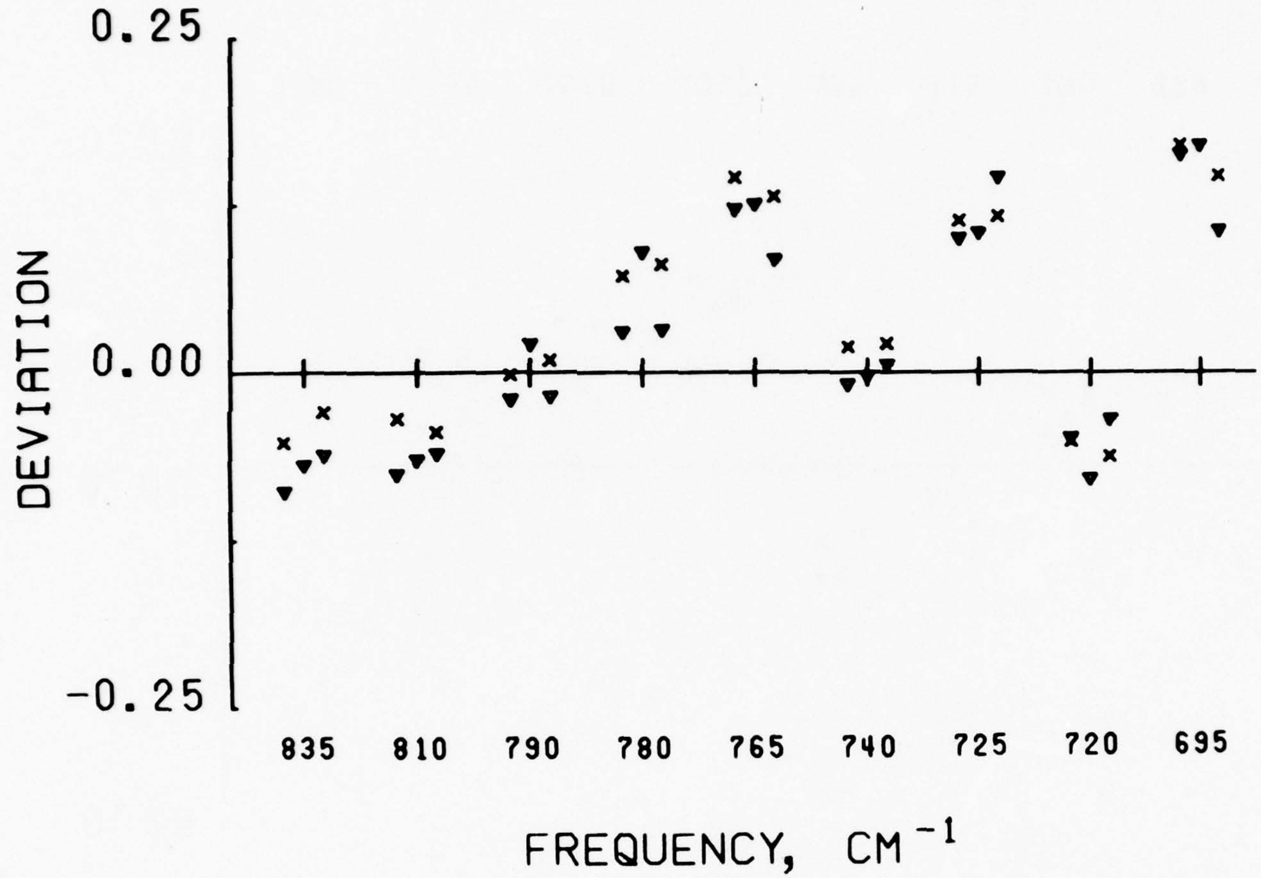

Figure 9-b. Continuation of Figure 9-a

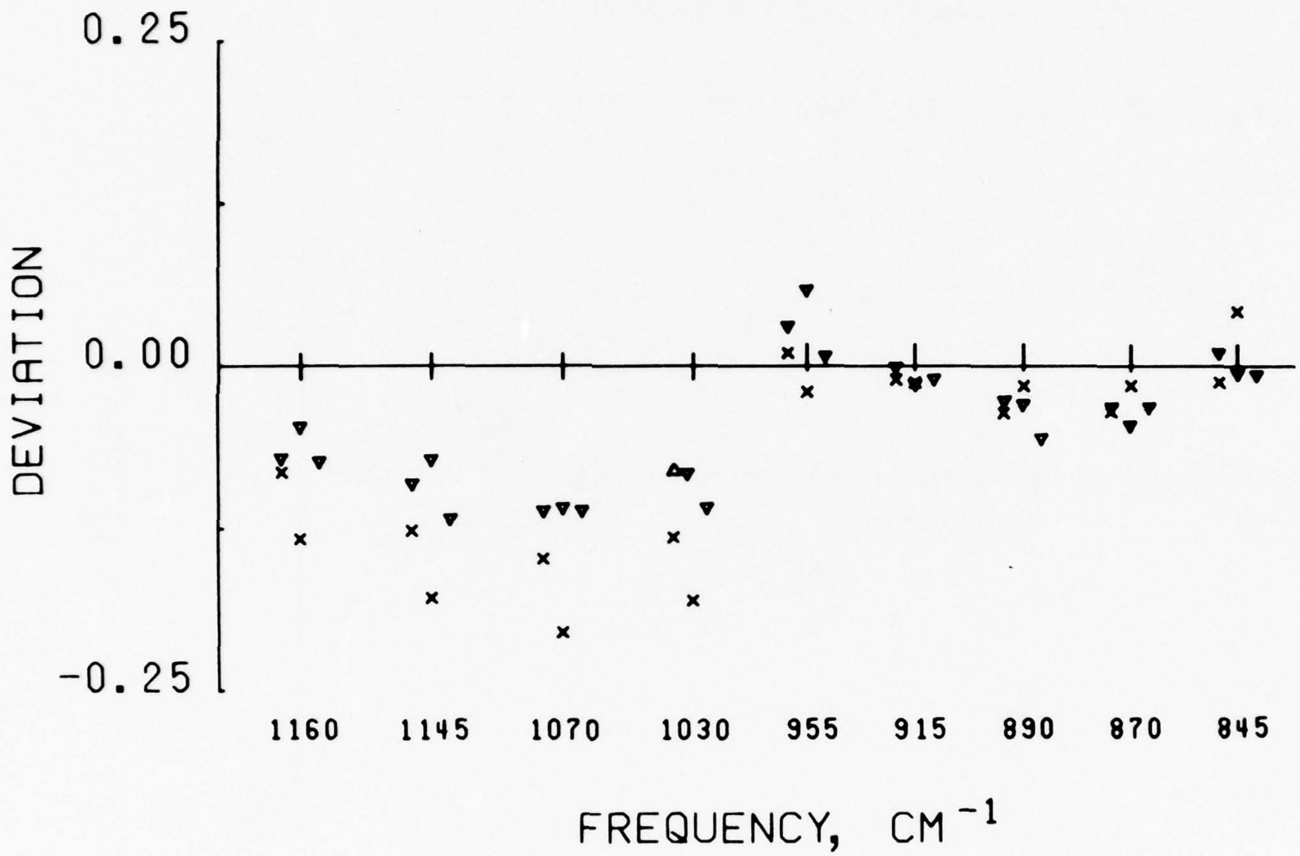

Figure 10-a. Crude 162: 162101 (X), 162102 (X), 162301 (∇), 162302 (∇), and 162303 (∇)

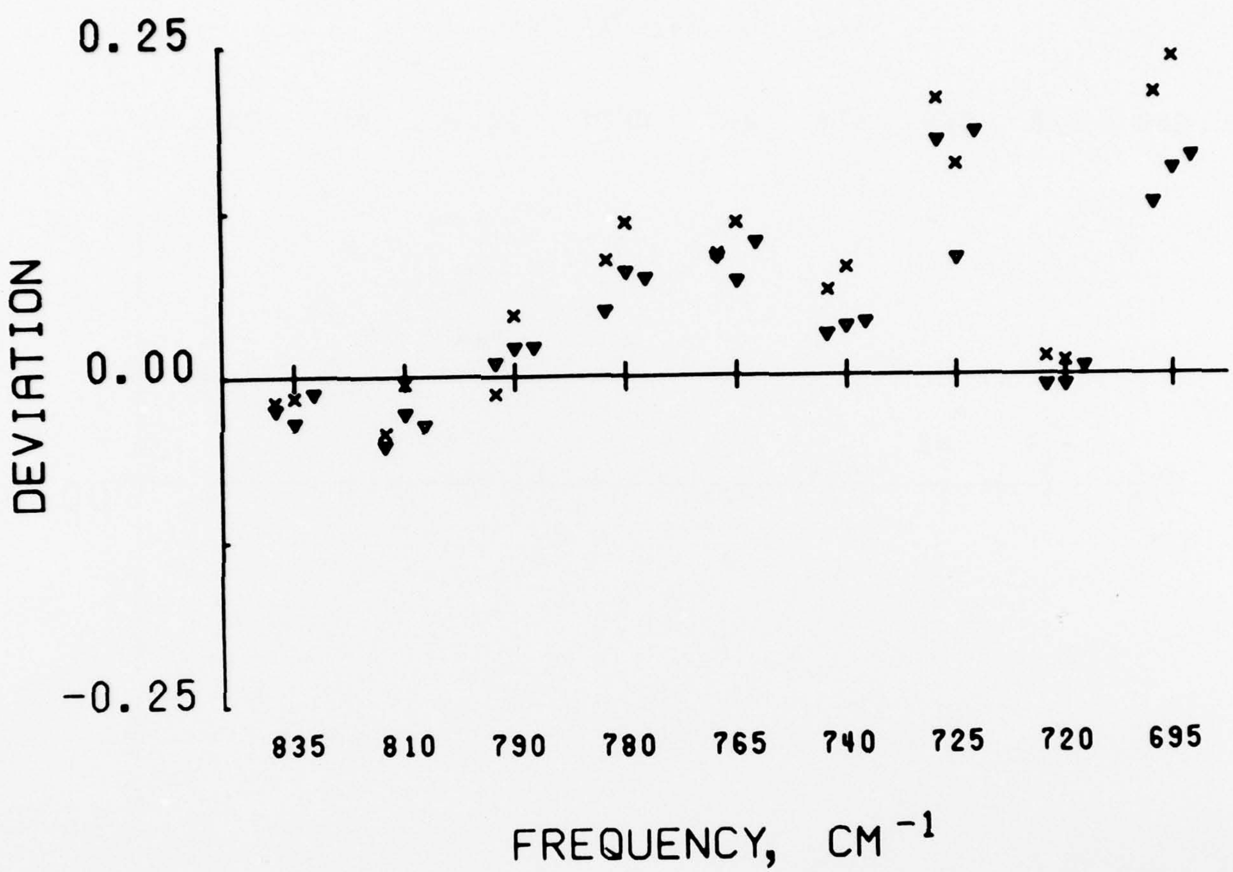

Figure 10-b. Continuation of Figure 10-a

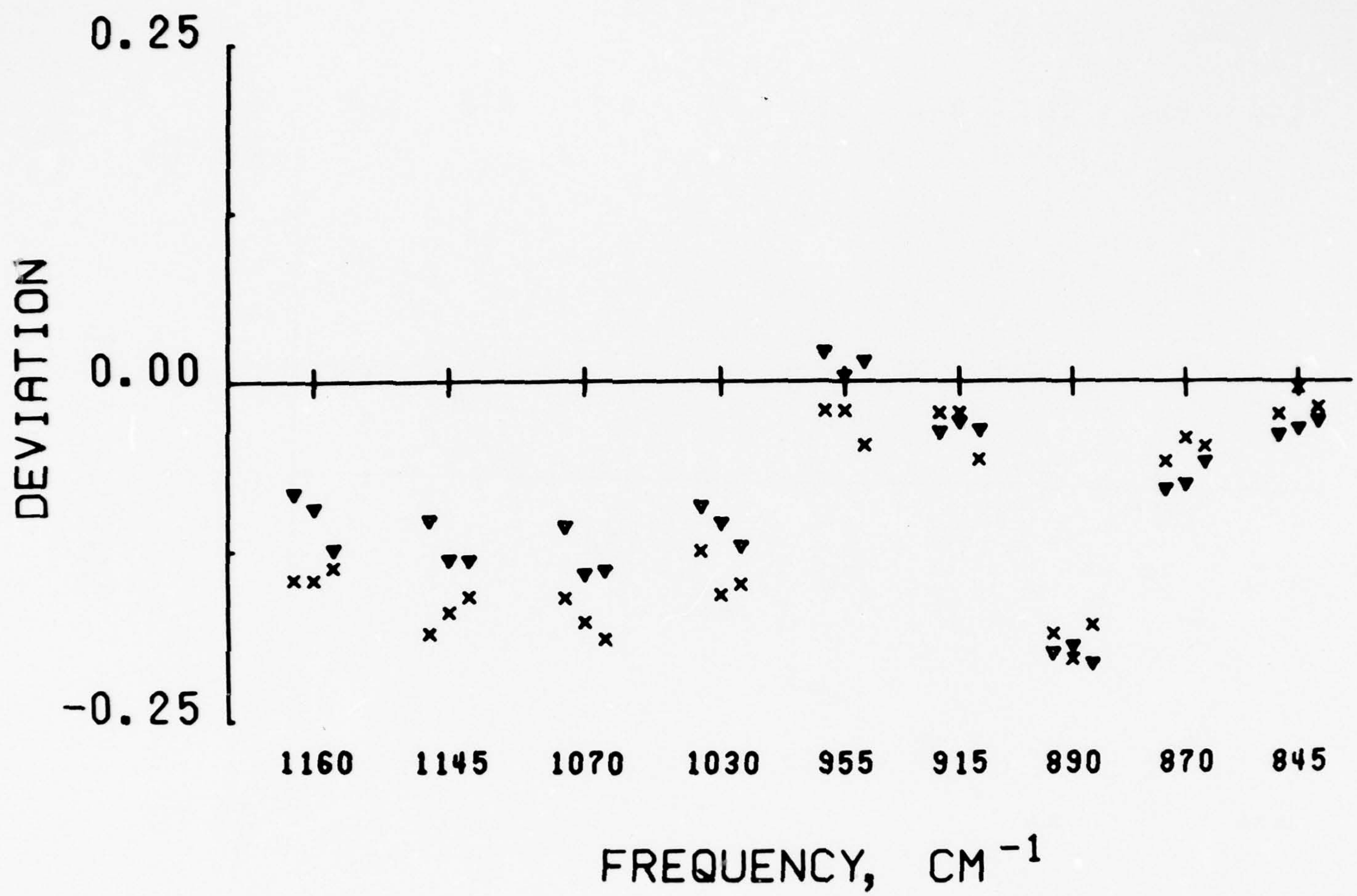

Figure 11-a. Crude 172: 172101 (X), 172102 (X), 172103 (X), 172311 (∇), 172312 (∇), and 172313 (∇)

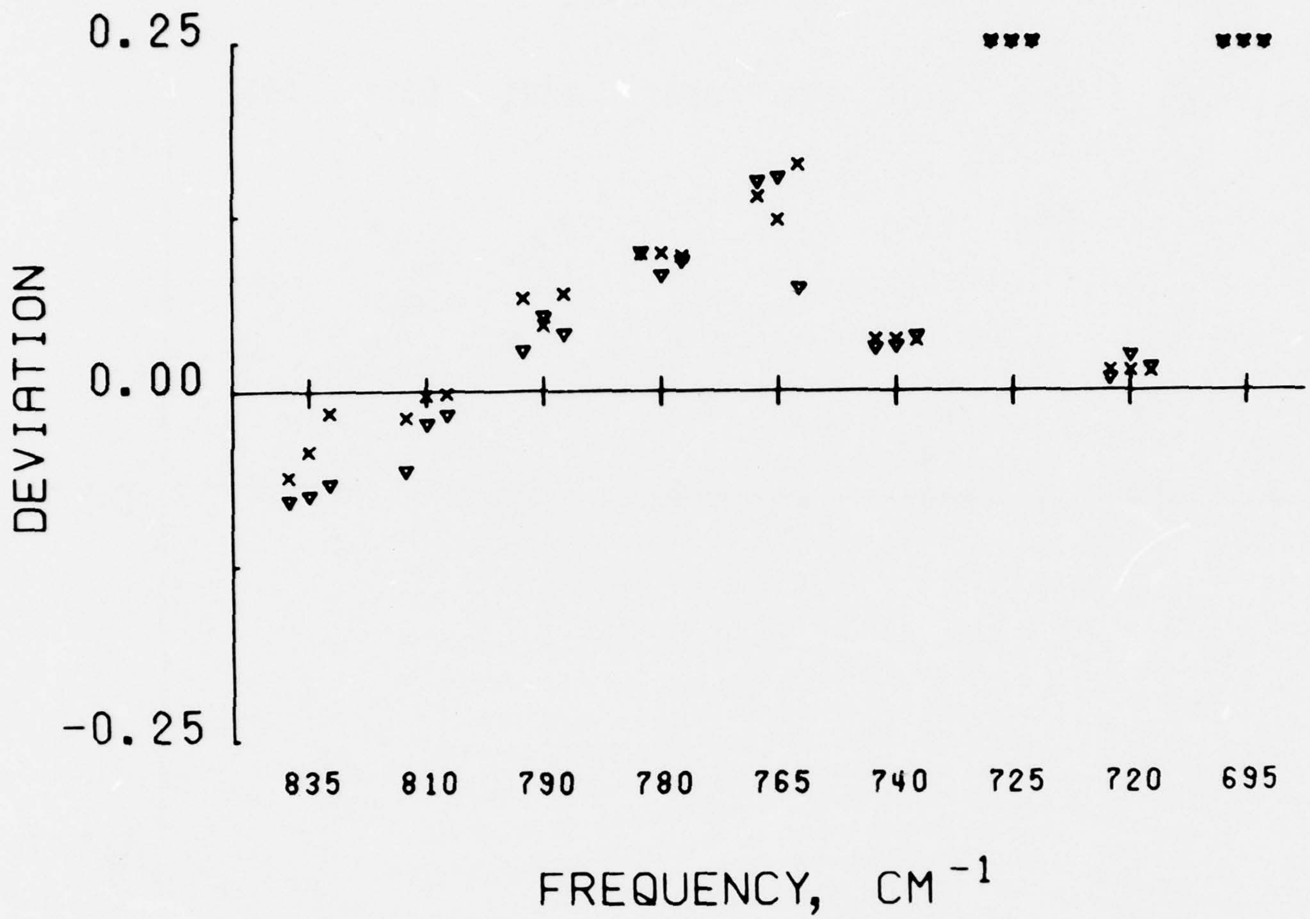

Figure 11-b. Continuation of Figure 11-a

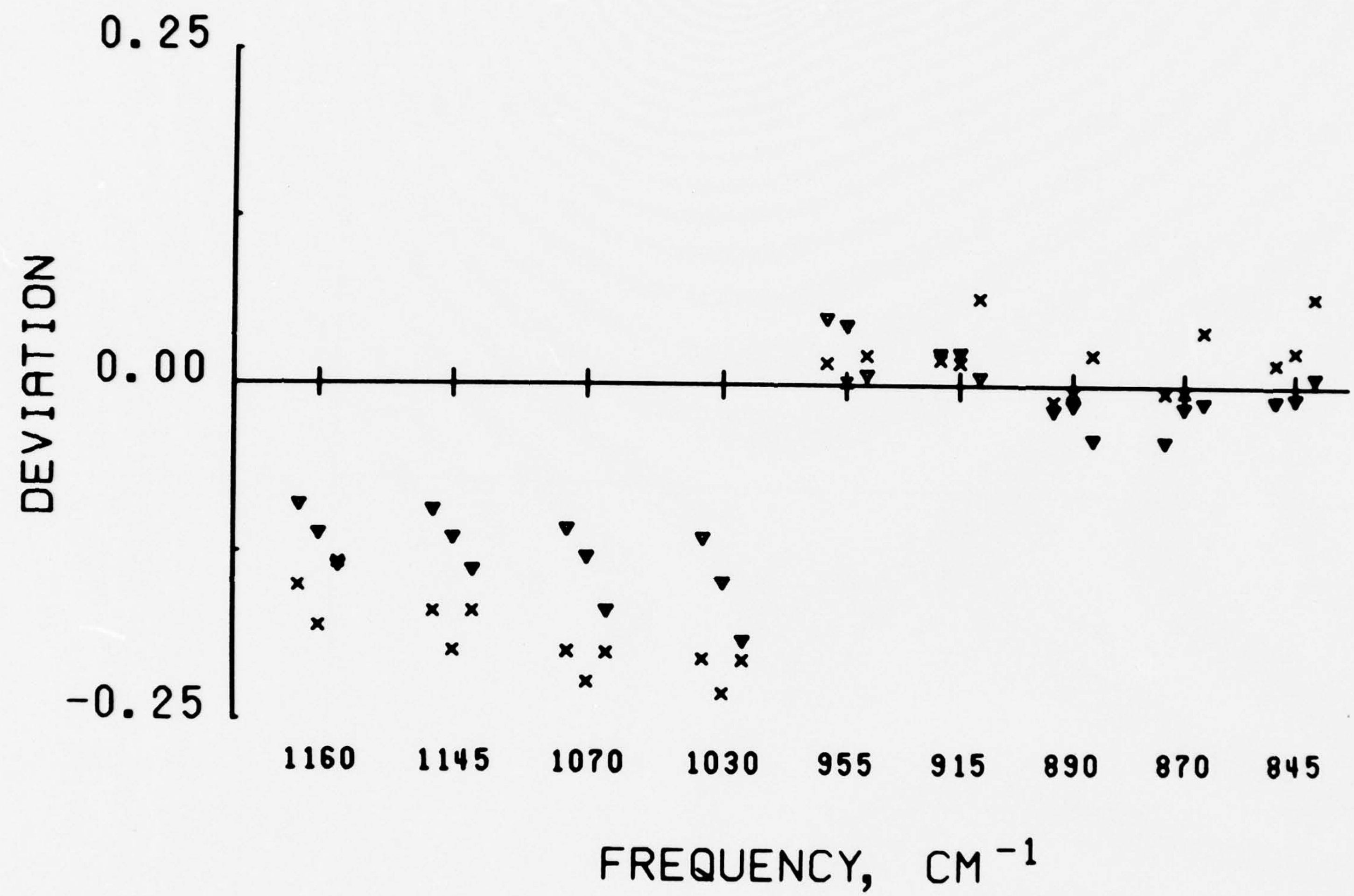

Figure 12-a. Crude 172: 174101 (X), 174102 (X), 174103 (X), 174311 (∇), 174312 (∇), and 174313 (∇)

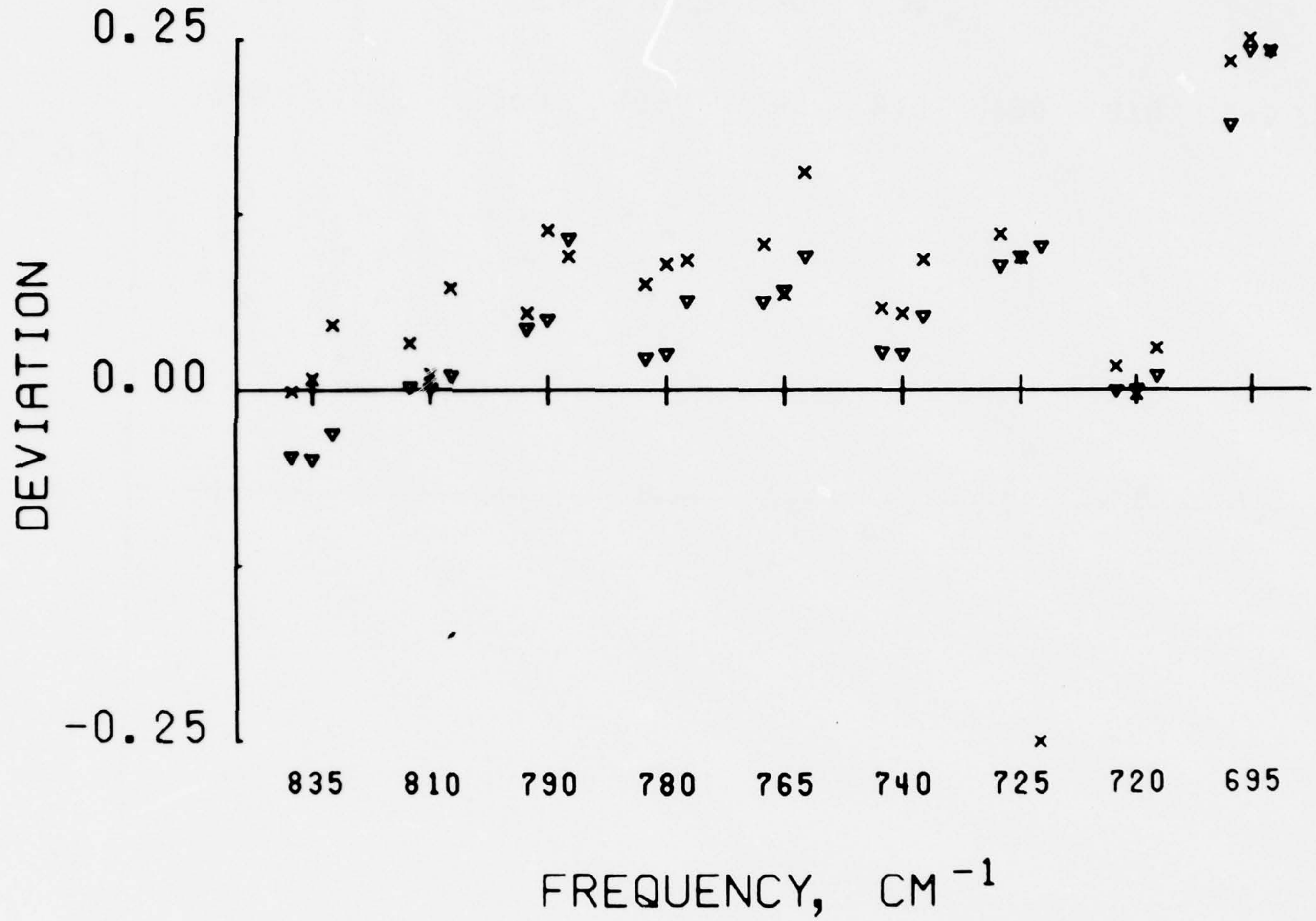

Figure 12-b. Continuation of Figure 12-a

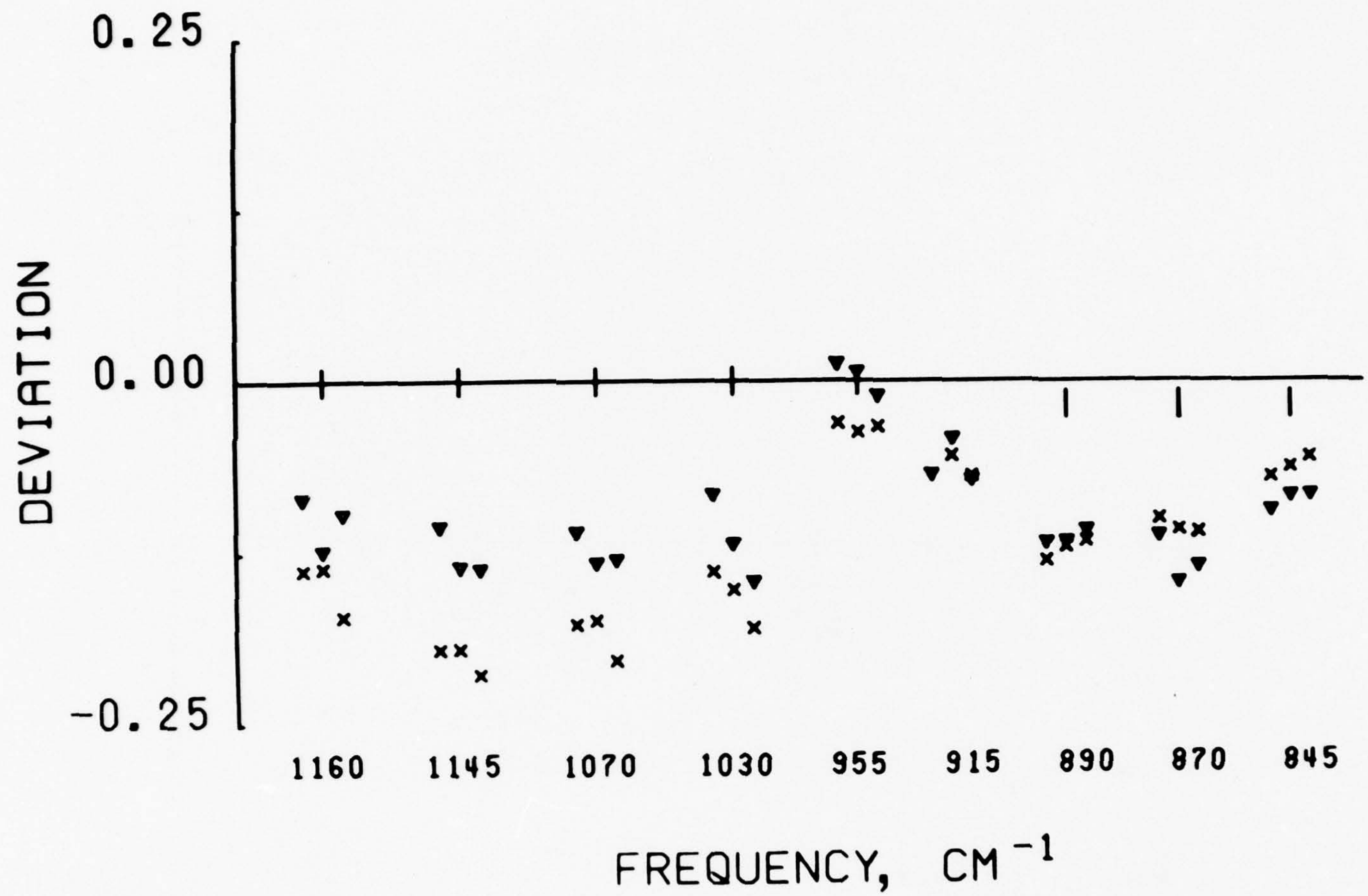

Figure 13-a. Crude 178: 178101 (X), 178102 (X), 178103 (X), 178301 (∇), 178302 (∇), and 178303 (∇)

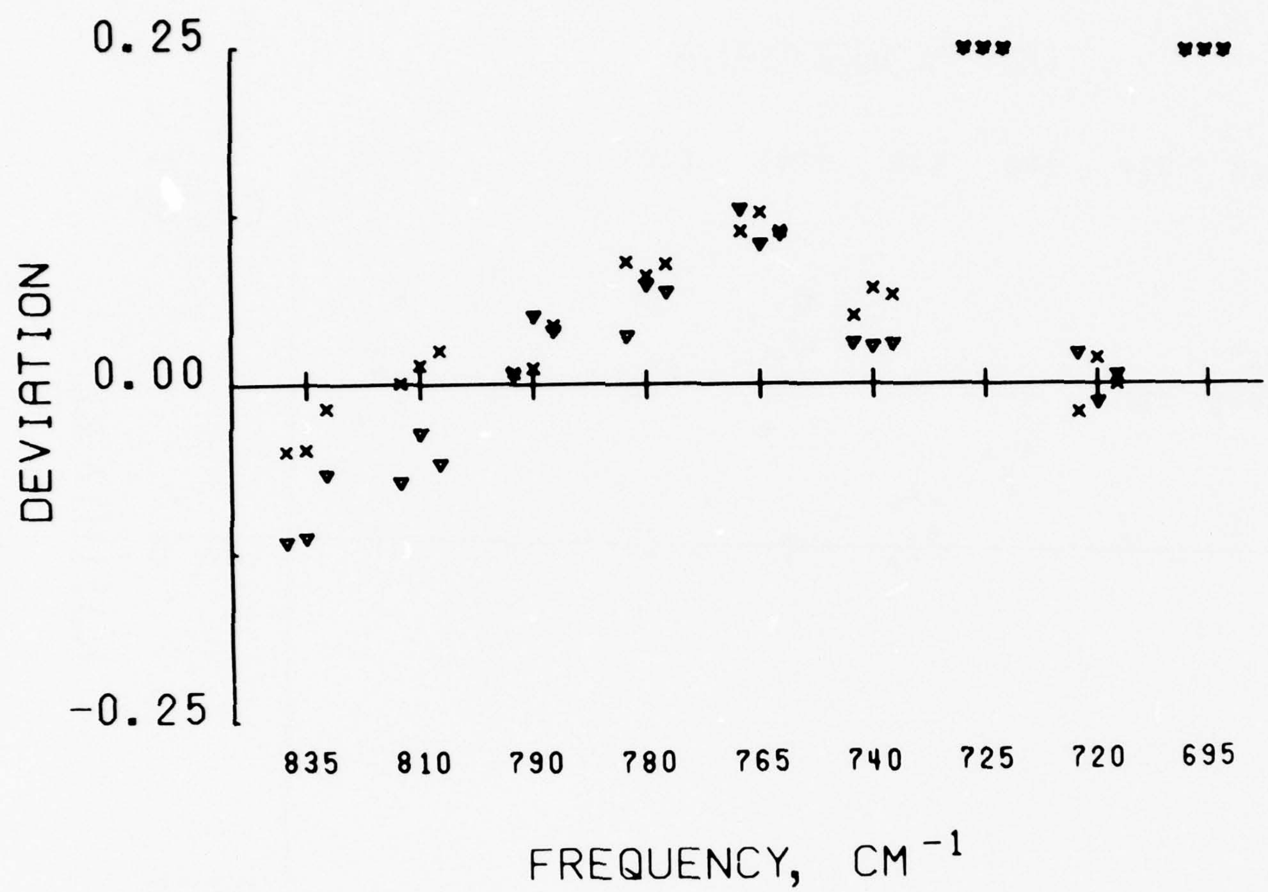

Figure 13-b. Continuation of Figure 13-a

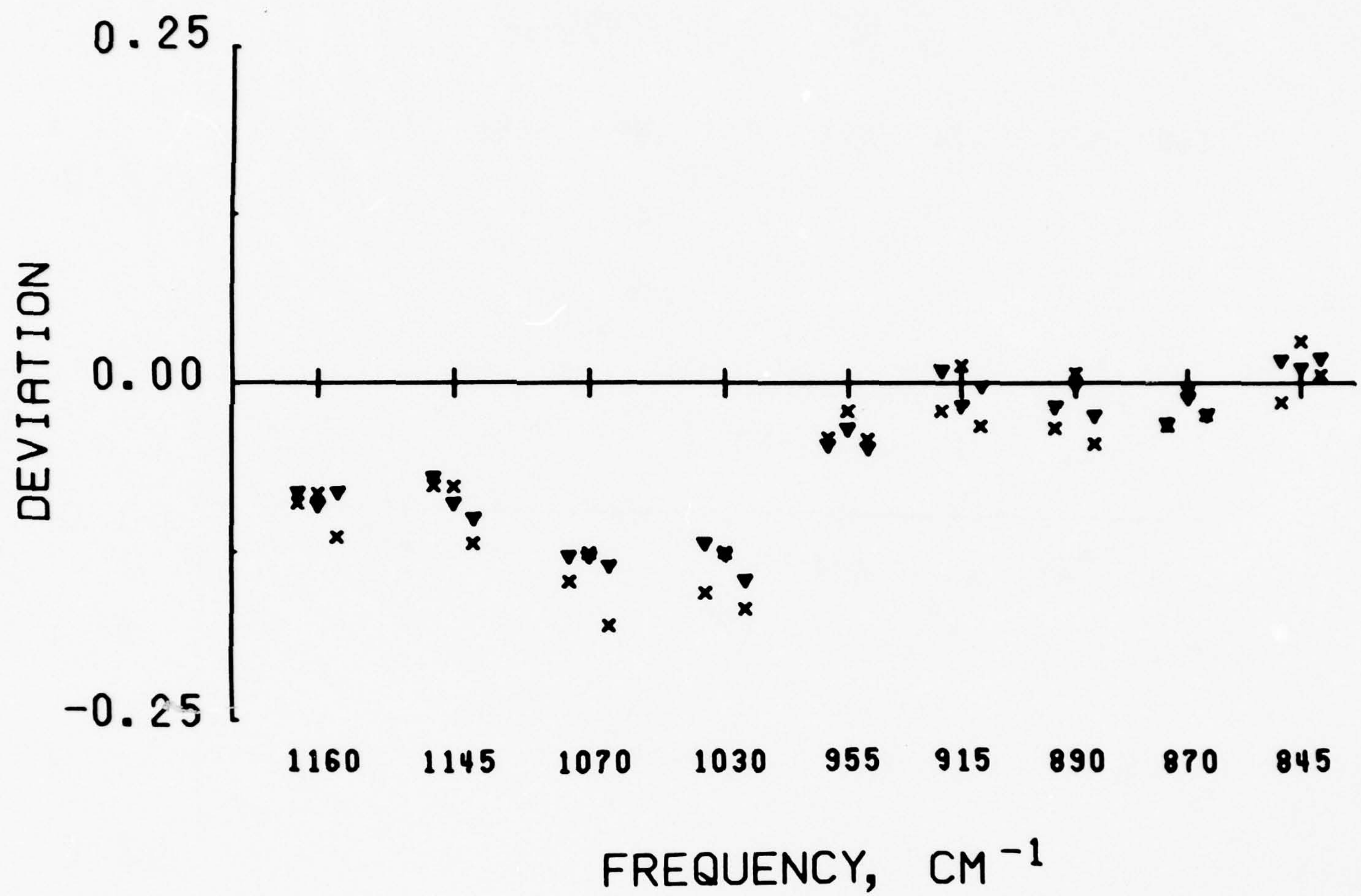

Figure 14-a. Crude 181: 181101 (X), 181102 (X), 181103 (X), 181311 (∇), 181312 (∇), and 181313 (∇)

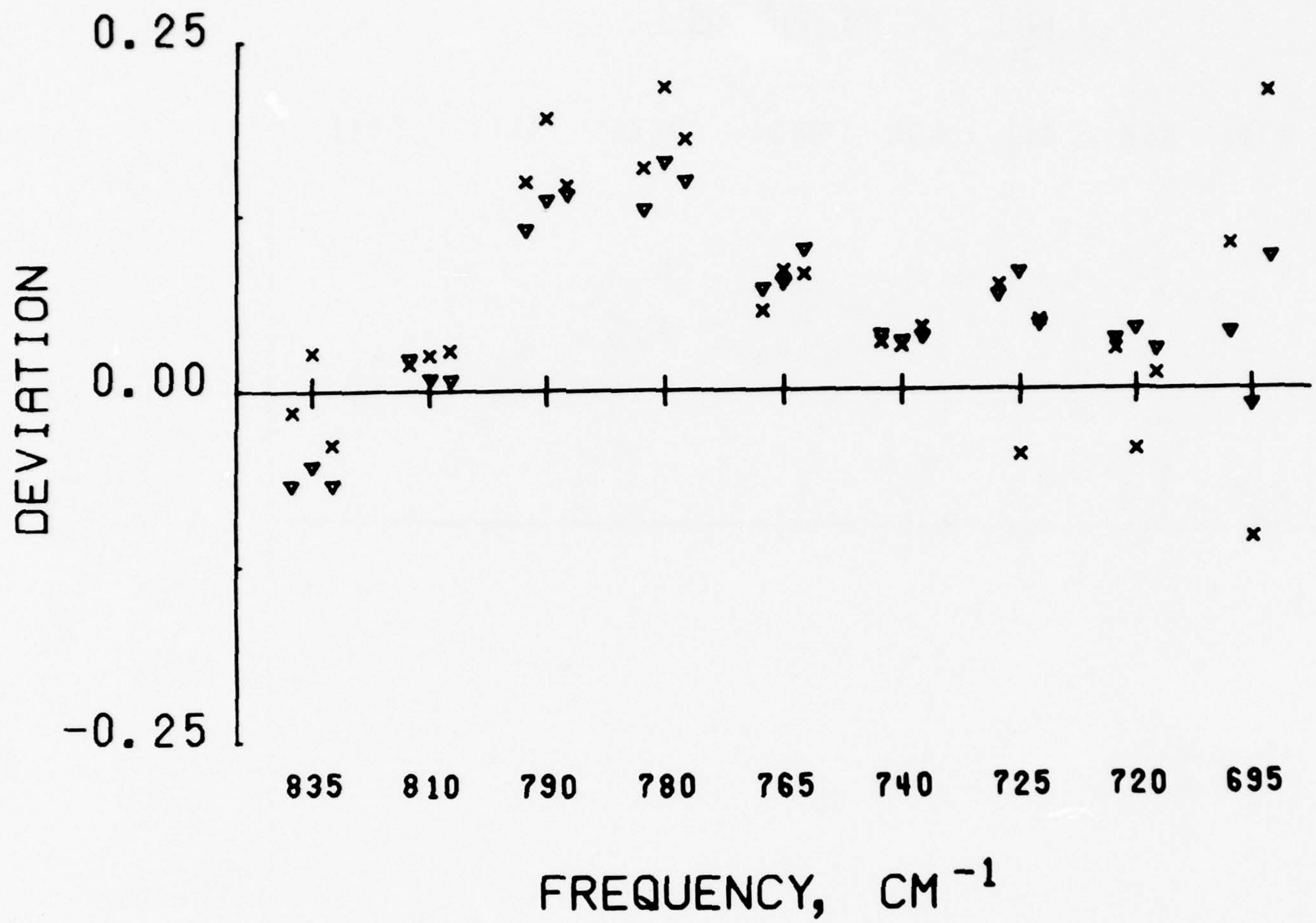

Figure 14-b. Continuation of Figure 14-a

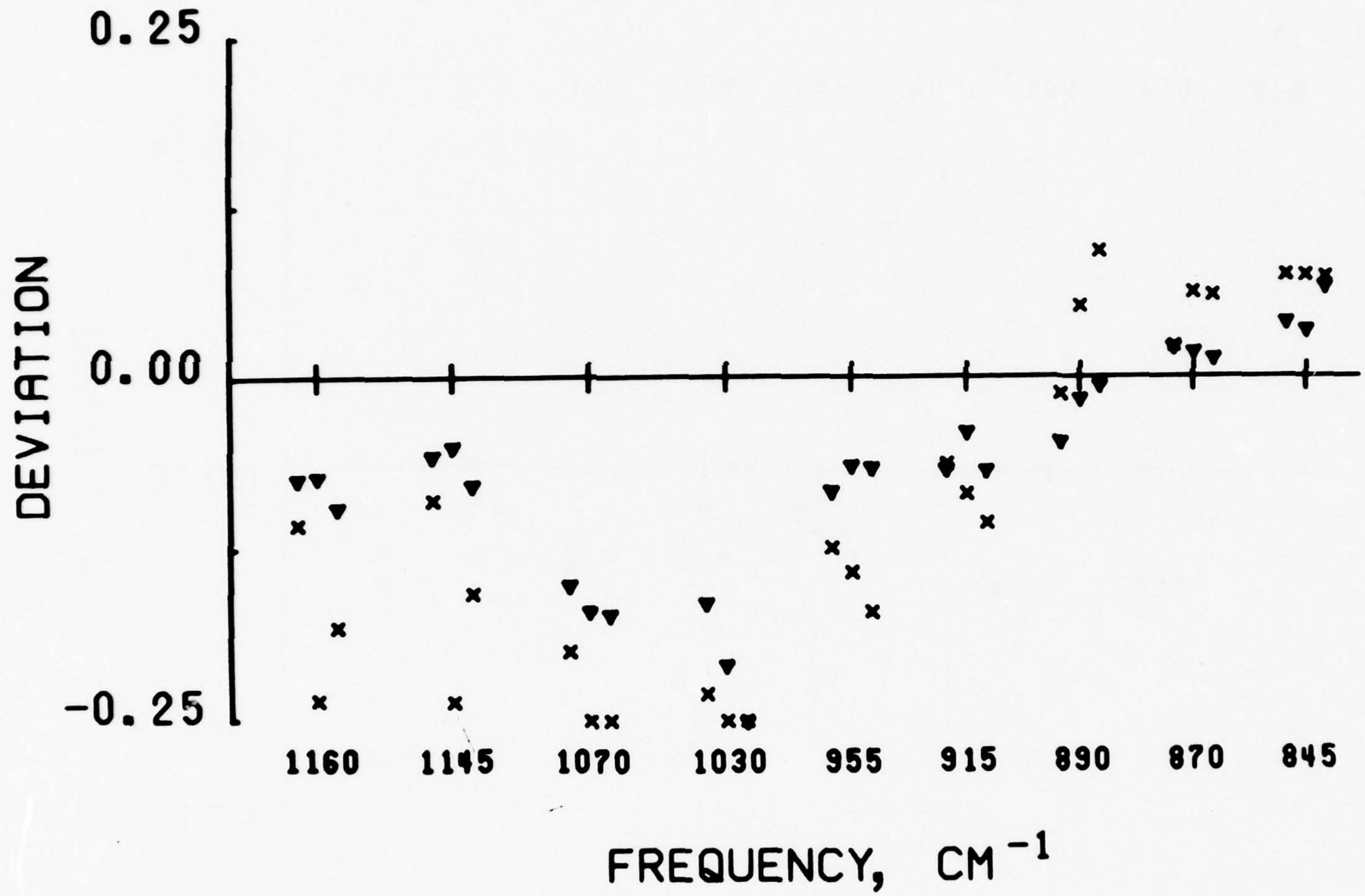

Figure 15-a. Crude 185: 185101 (X), 185102 (X), 185103 (X), 185301 (∇), 185302 (∇), and 185303 (∇)

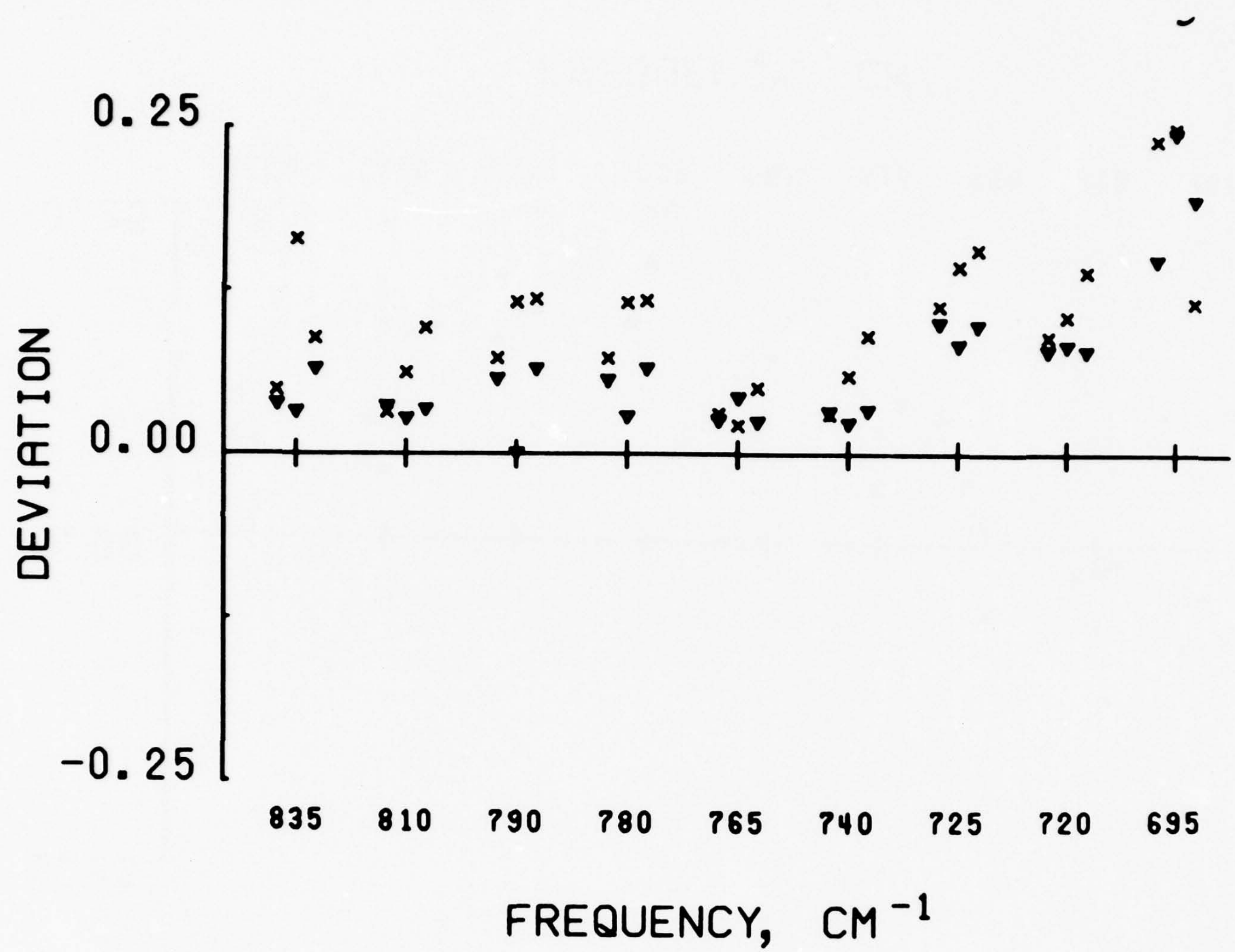

Figure 15-b. Continuation of Figure 15-a

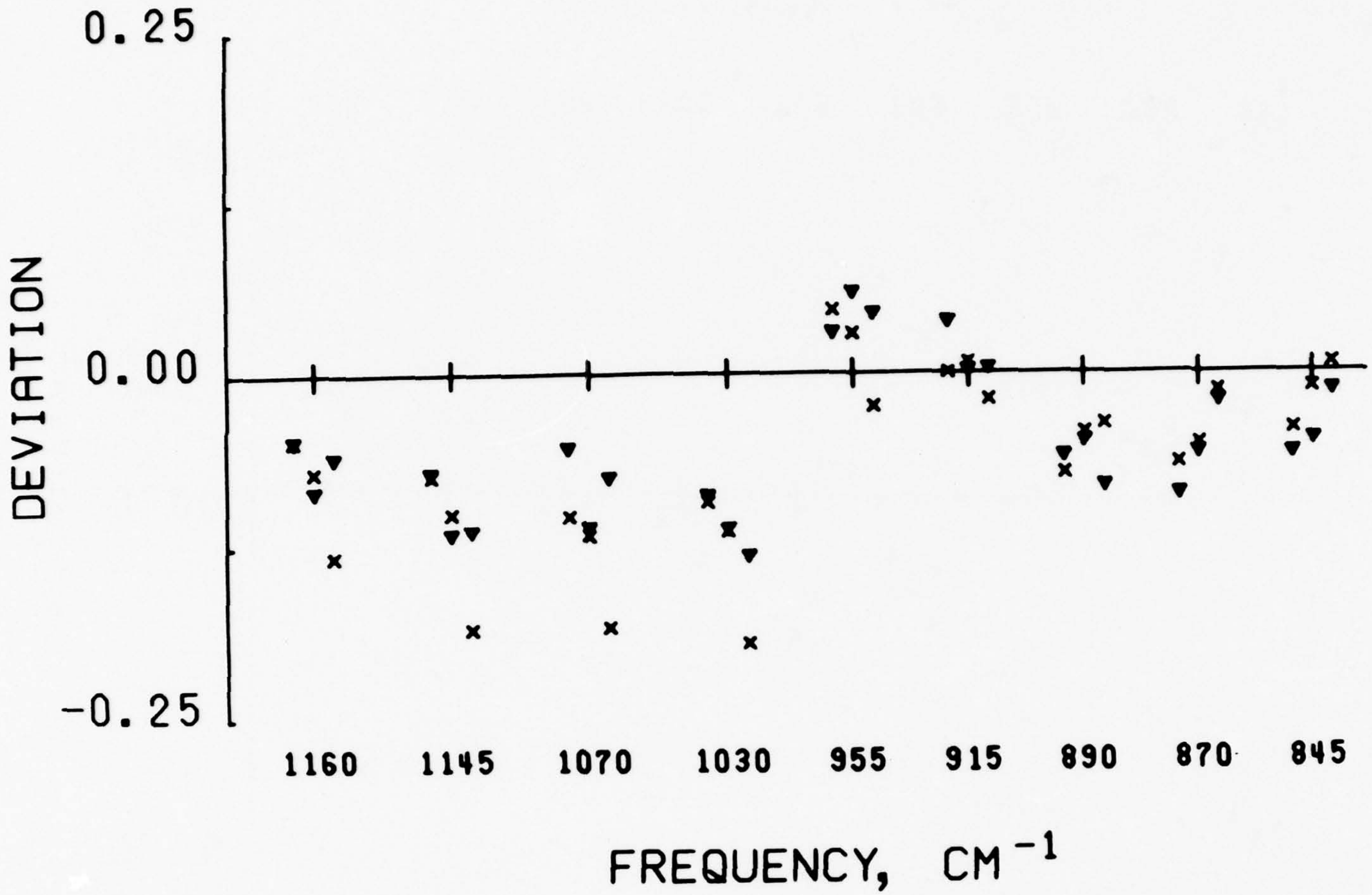

Figure 16-a. Crude 186: 186461 (X), 186462 (X), 186463 (X), 186381 (∇), 186382 (∇), and 186383 (∇)

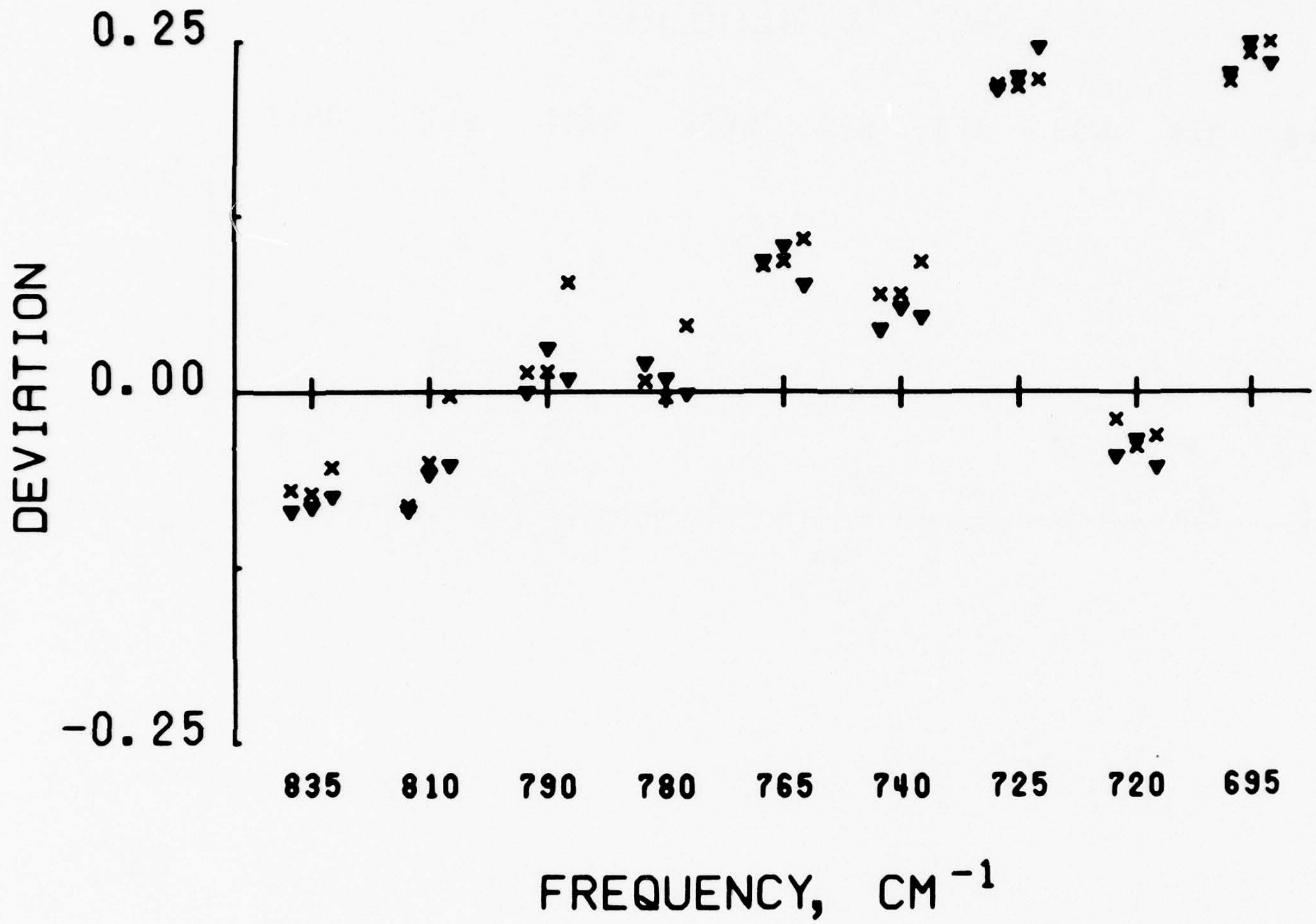

Figure 16-b. Continuation of Figure 16-a

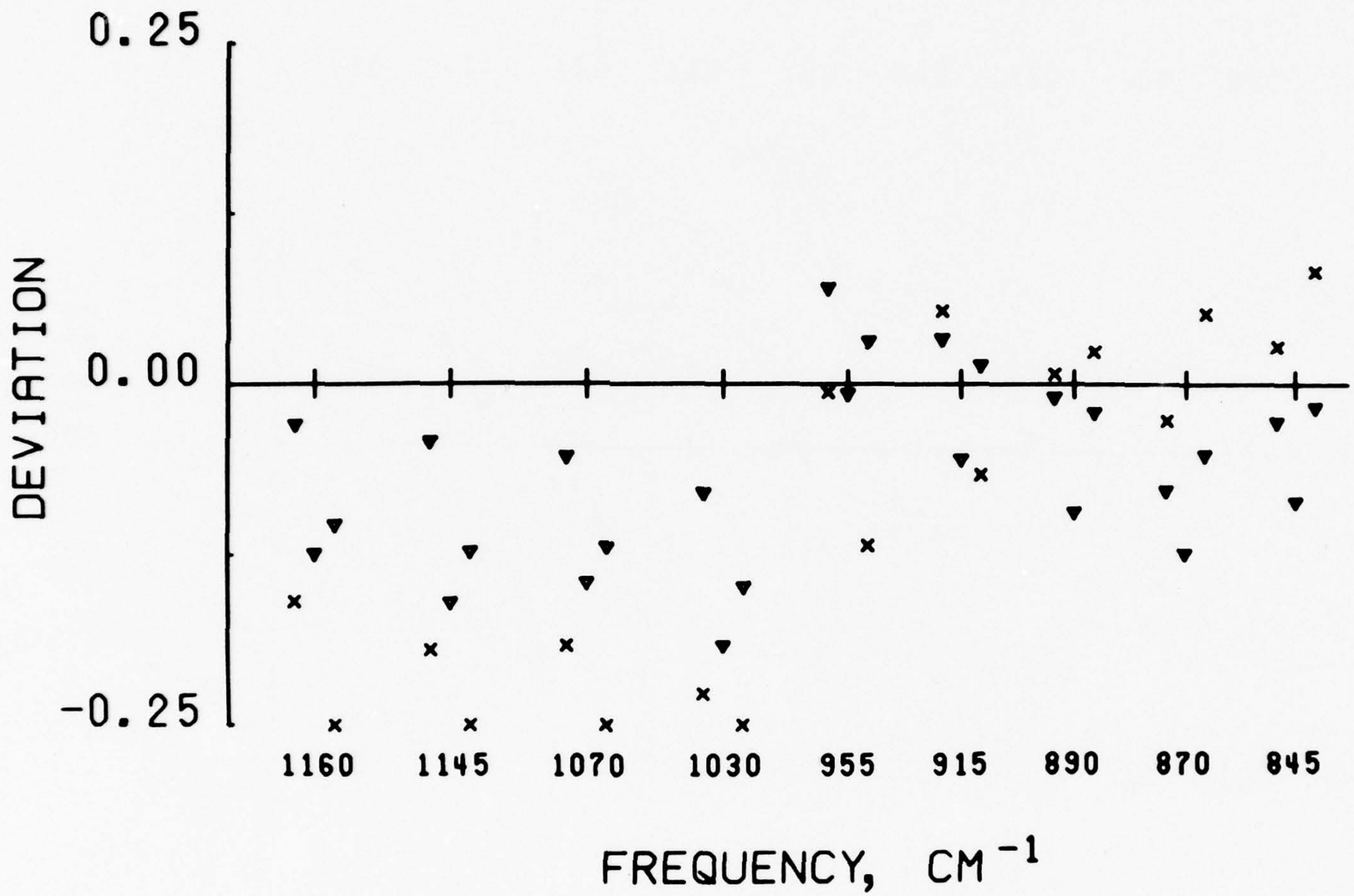

Figure 17-a. Crude 188: 188481 (X), 188483 (X), 188301 (∇), 188302 (∇), and 188303 (∇)

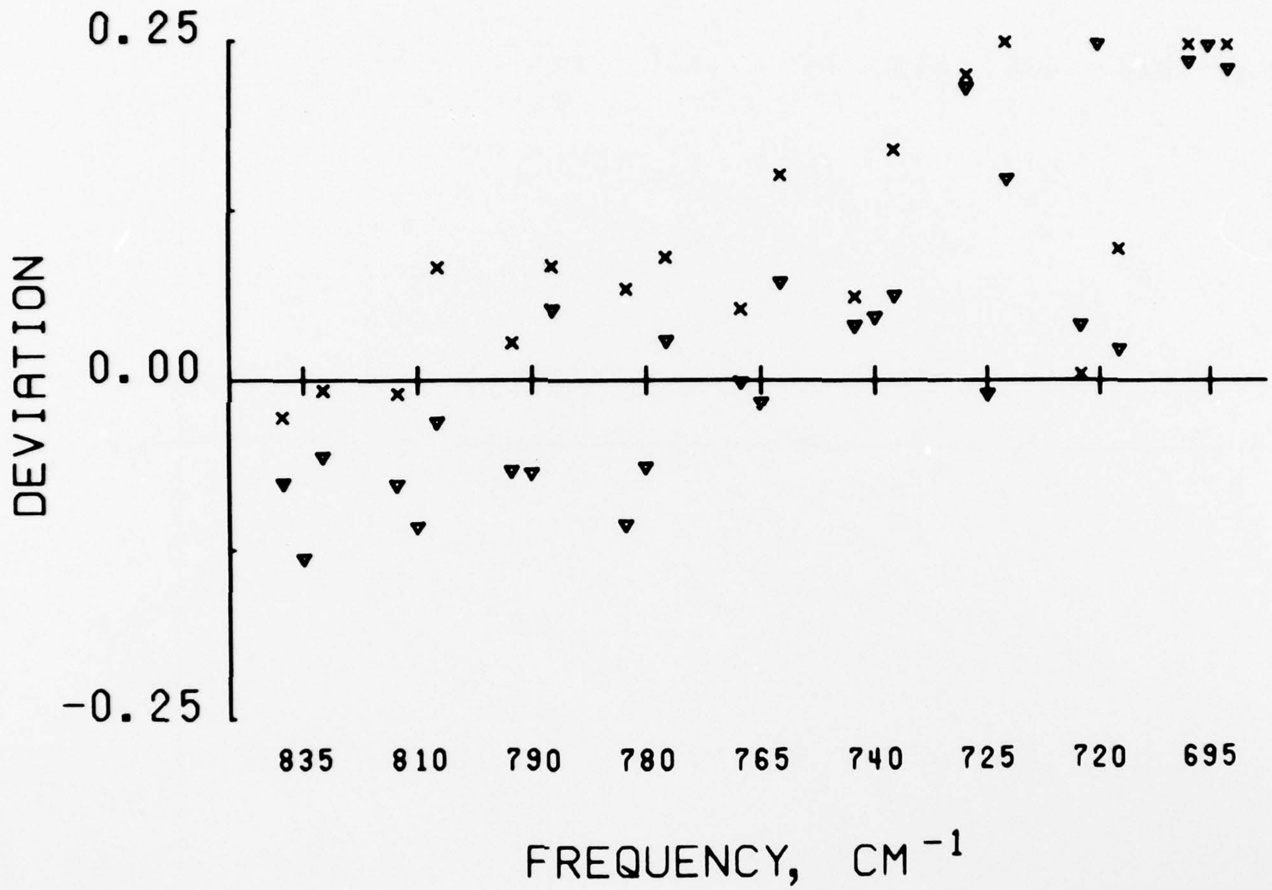

Figure 17-b. Continuation of Figure 17-a

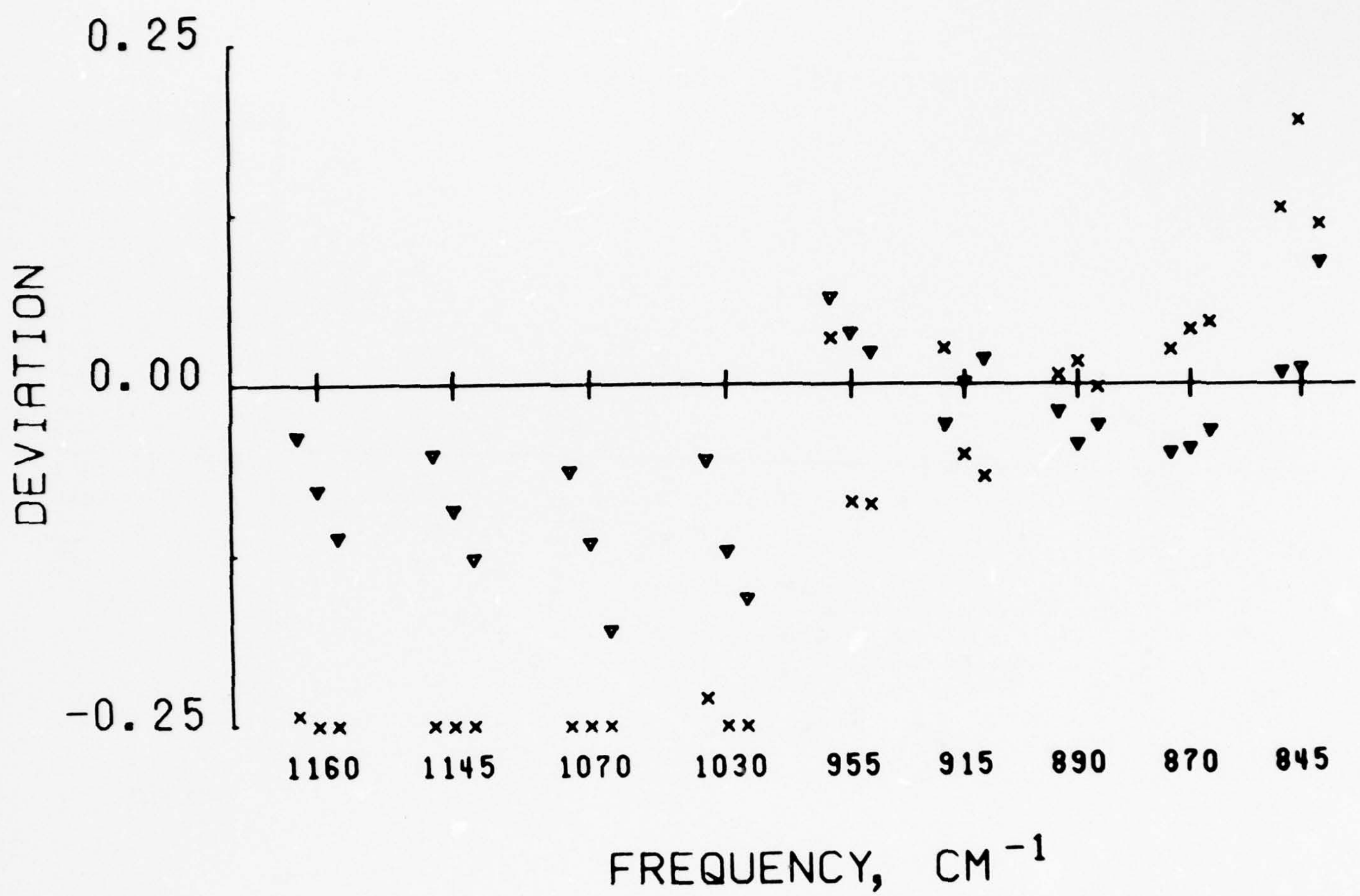

Figure 18-a. Crude 192: 192481 (X), 192482 (X), 192483 (X), 192301 (∇), 192302 (∇), and 192303 (∇)

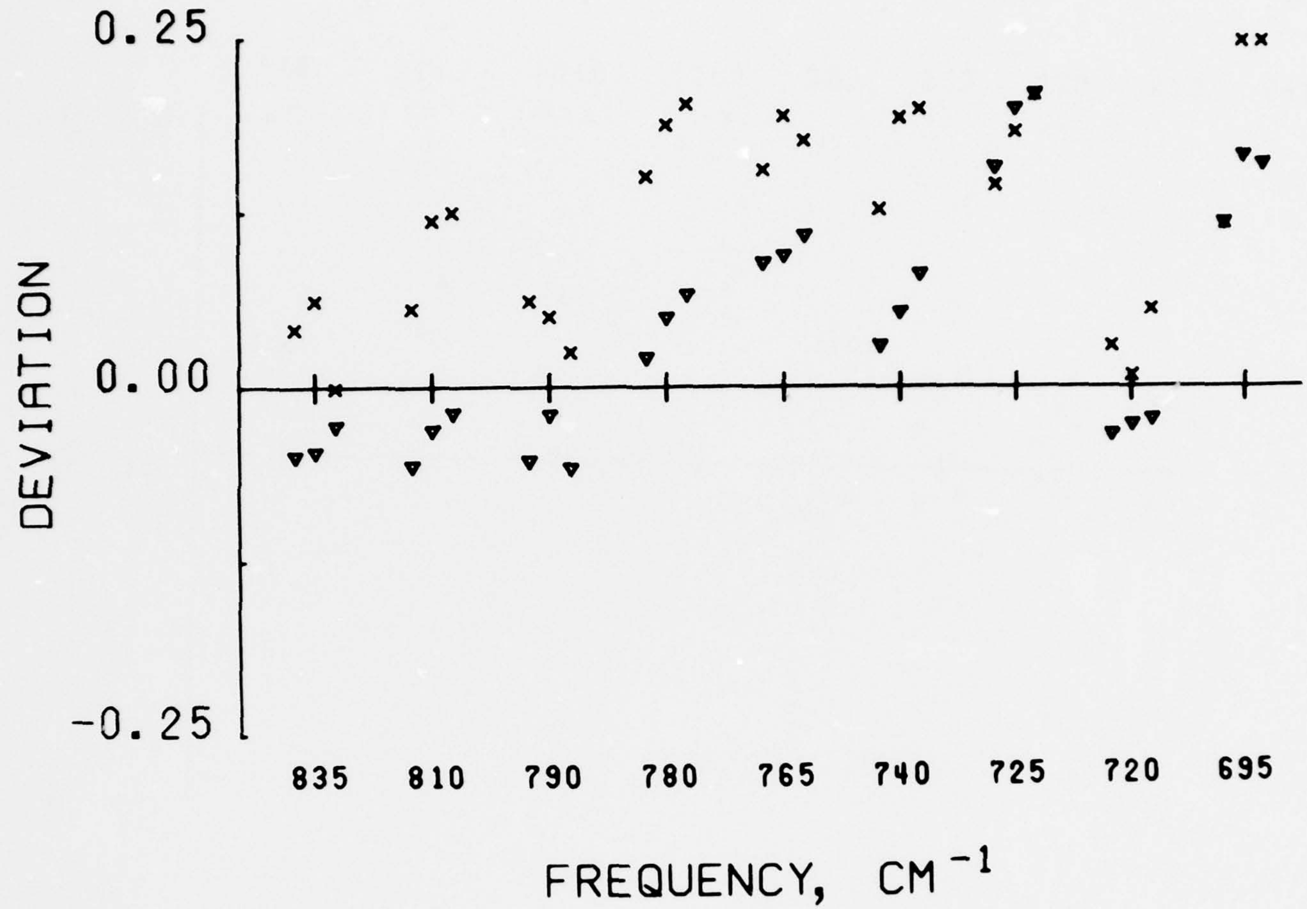

Figure 18-b. Continuation of Figure 18-a

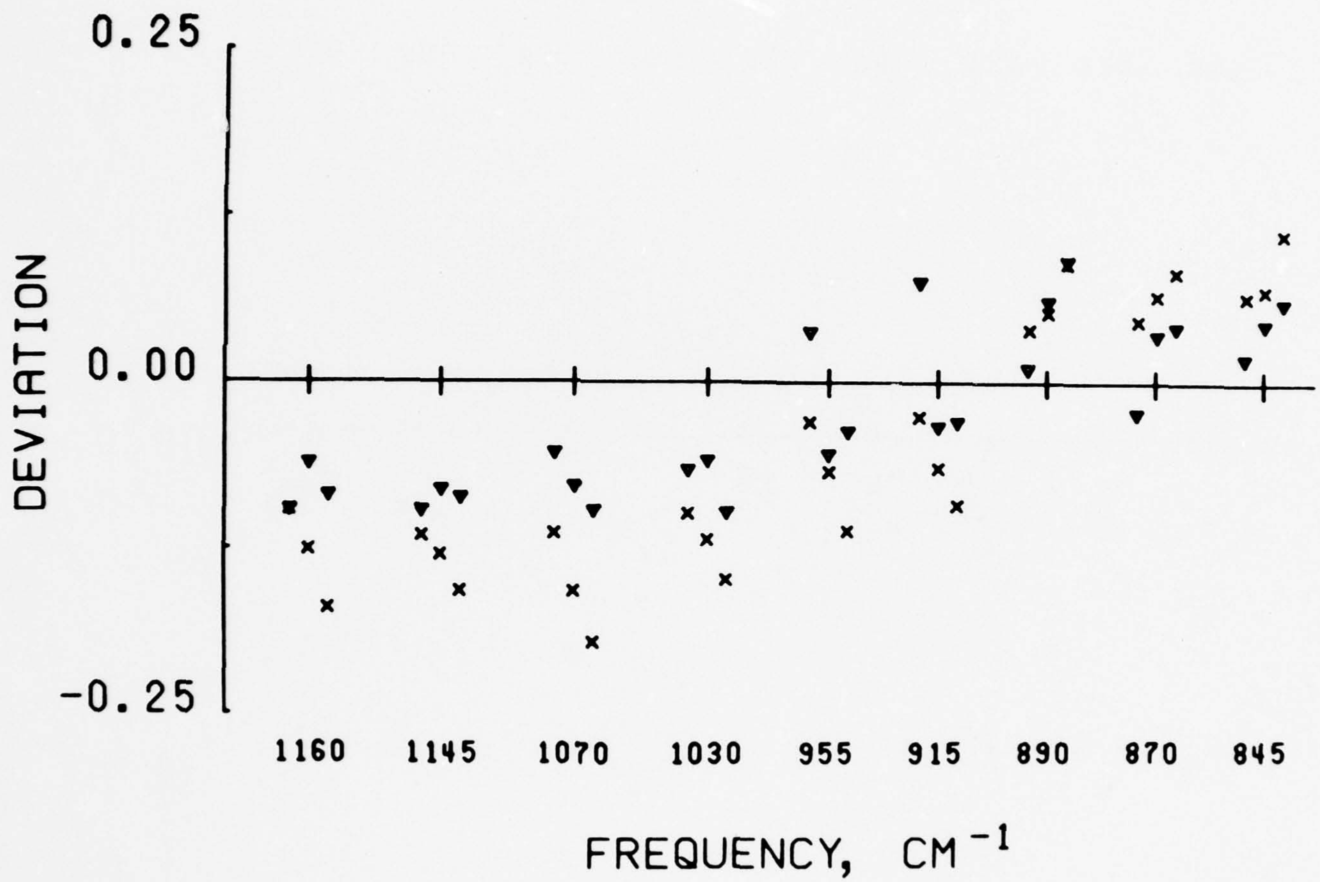

Figure 19-a. No. 6 fuel 605: 605101 (X), 605102 (X), 605103 (X), 605311 (∇), 605312 (∇), and 605313 (∇)

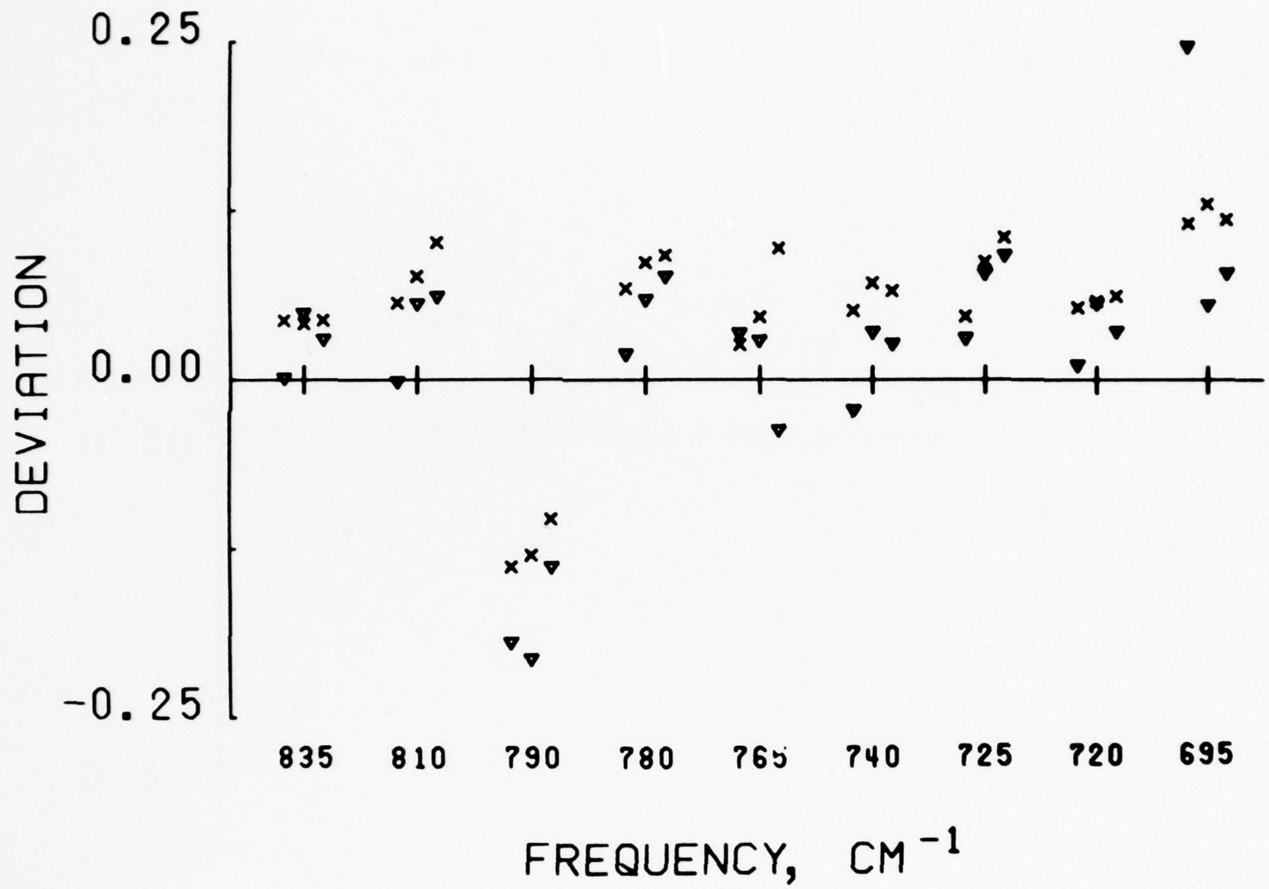

Figure 19-b. Continuation of Figure 19-a

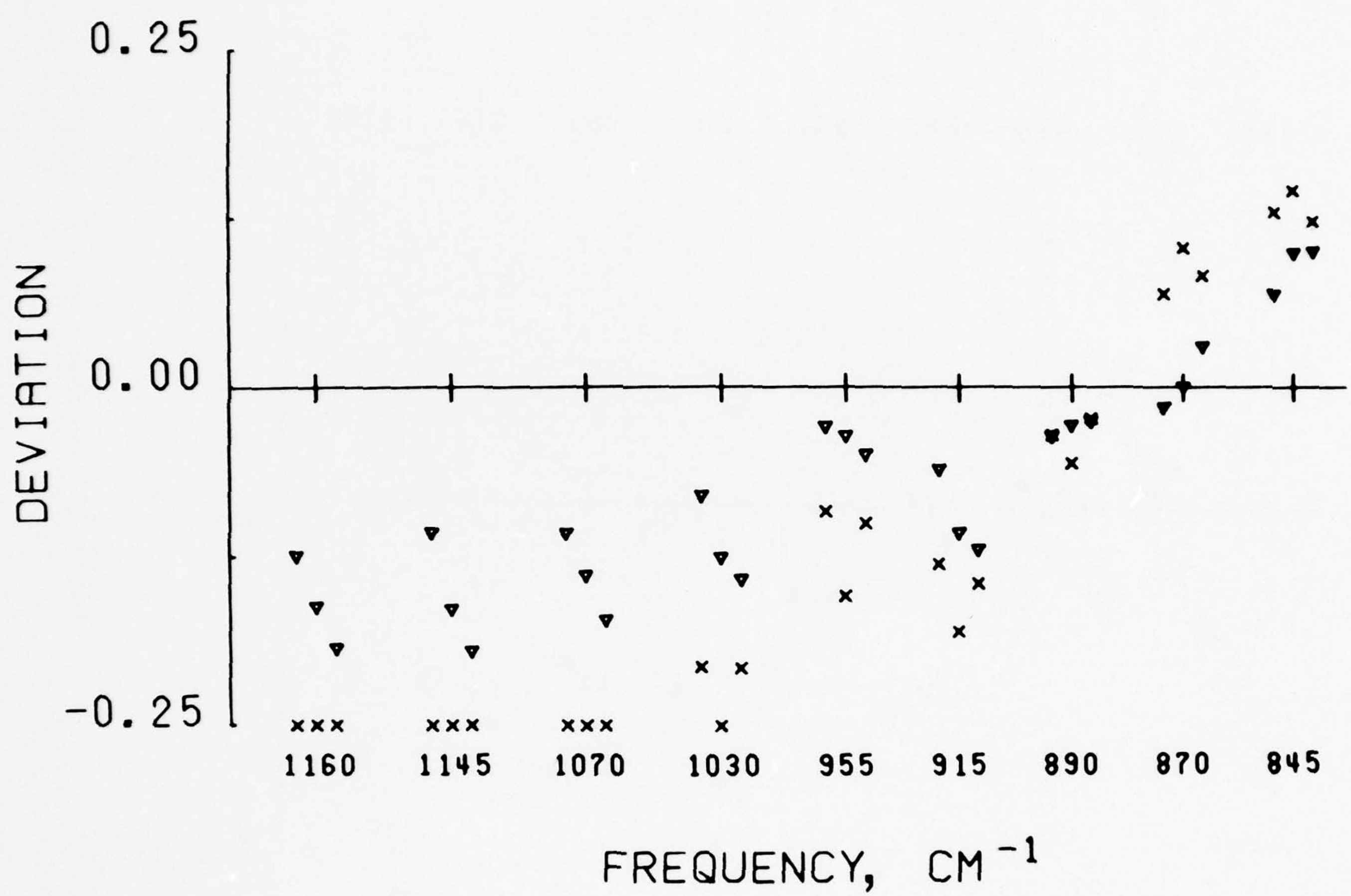

Figure 20-a. No. 5 fuel 607: 607101 (X), 607102 (X), 607103 (X), 607311 (∇), 607312 (∇), and 607313 (∇)

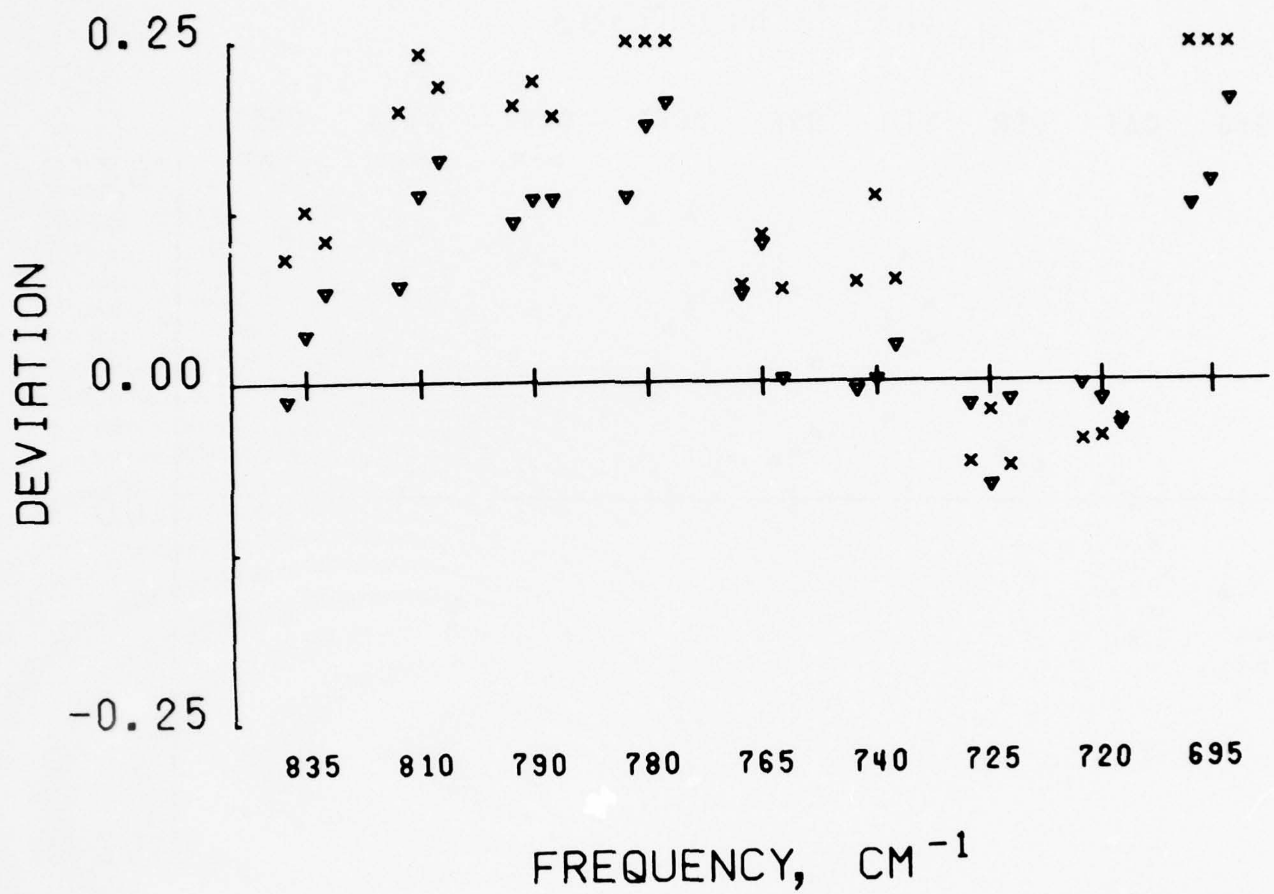

Figure 20-b. Continuation of Figure 20-a

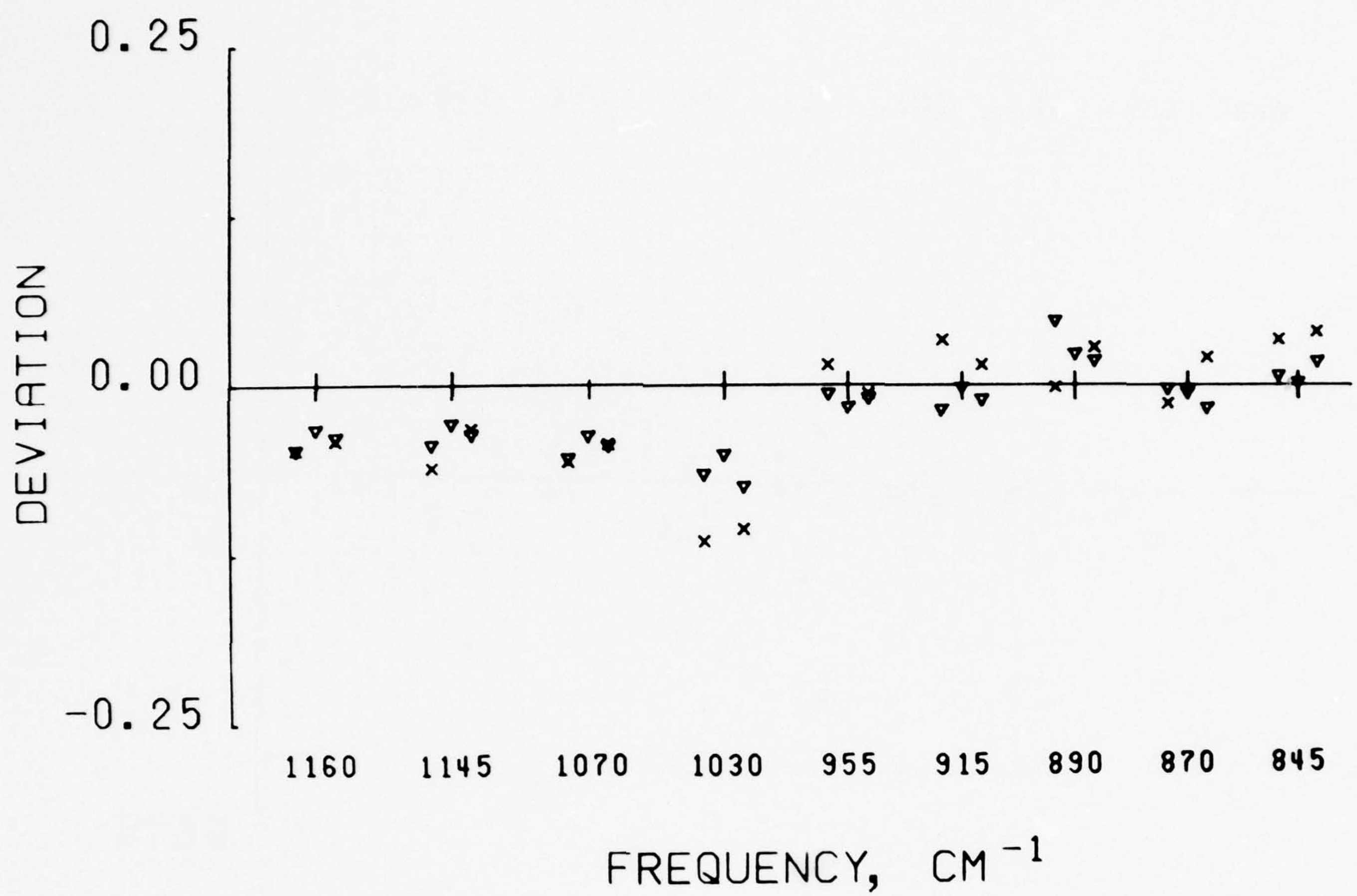

Figure 21-a, No. 6 fuel 610: 610101 (X), 610103 (X), 610301 (∇), 610302 (∇), and 610303 (∇)

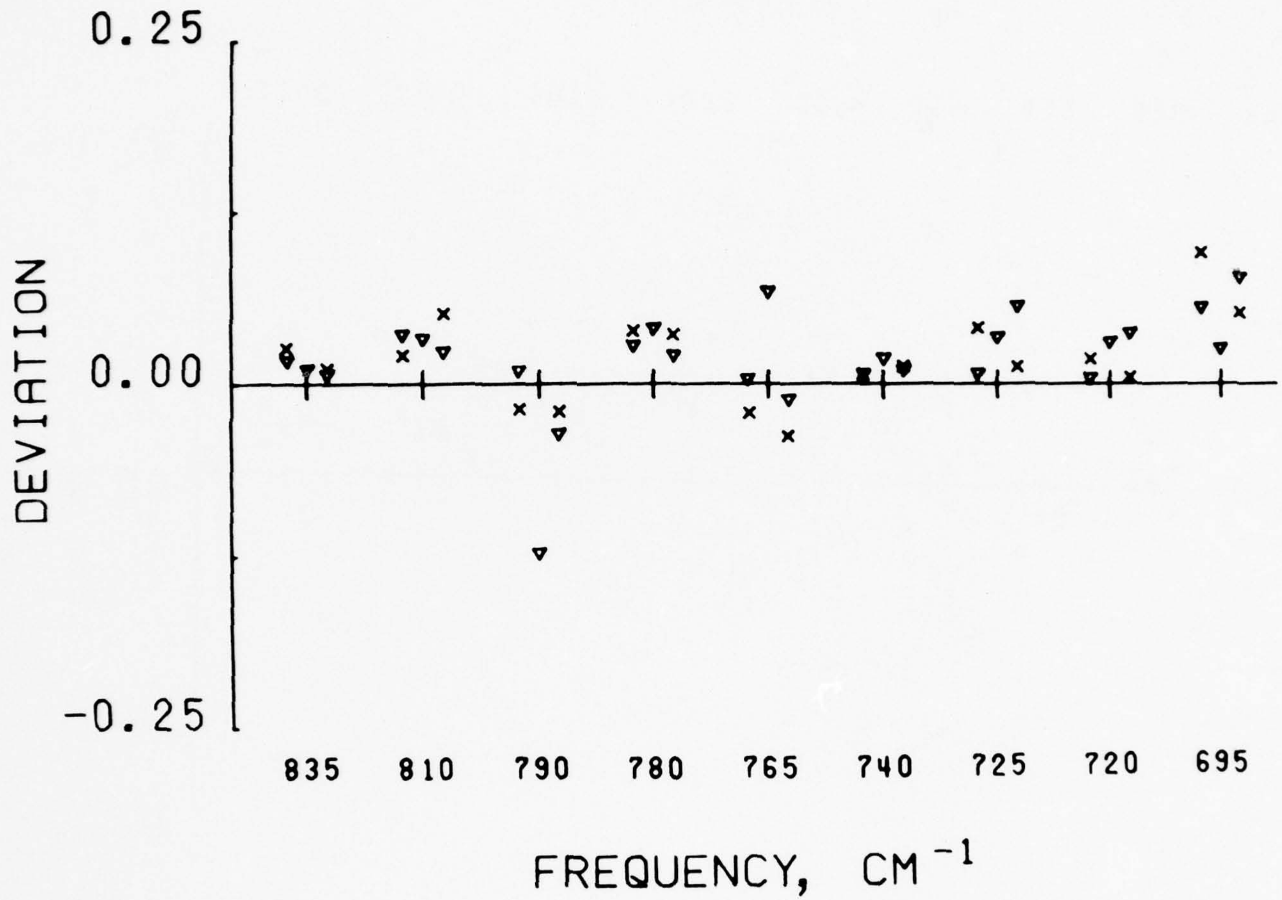

Figure 21-b. Continuation of Figure 21-a

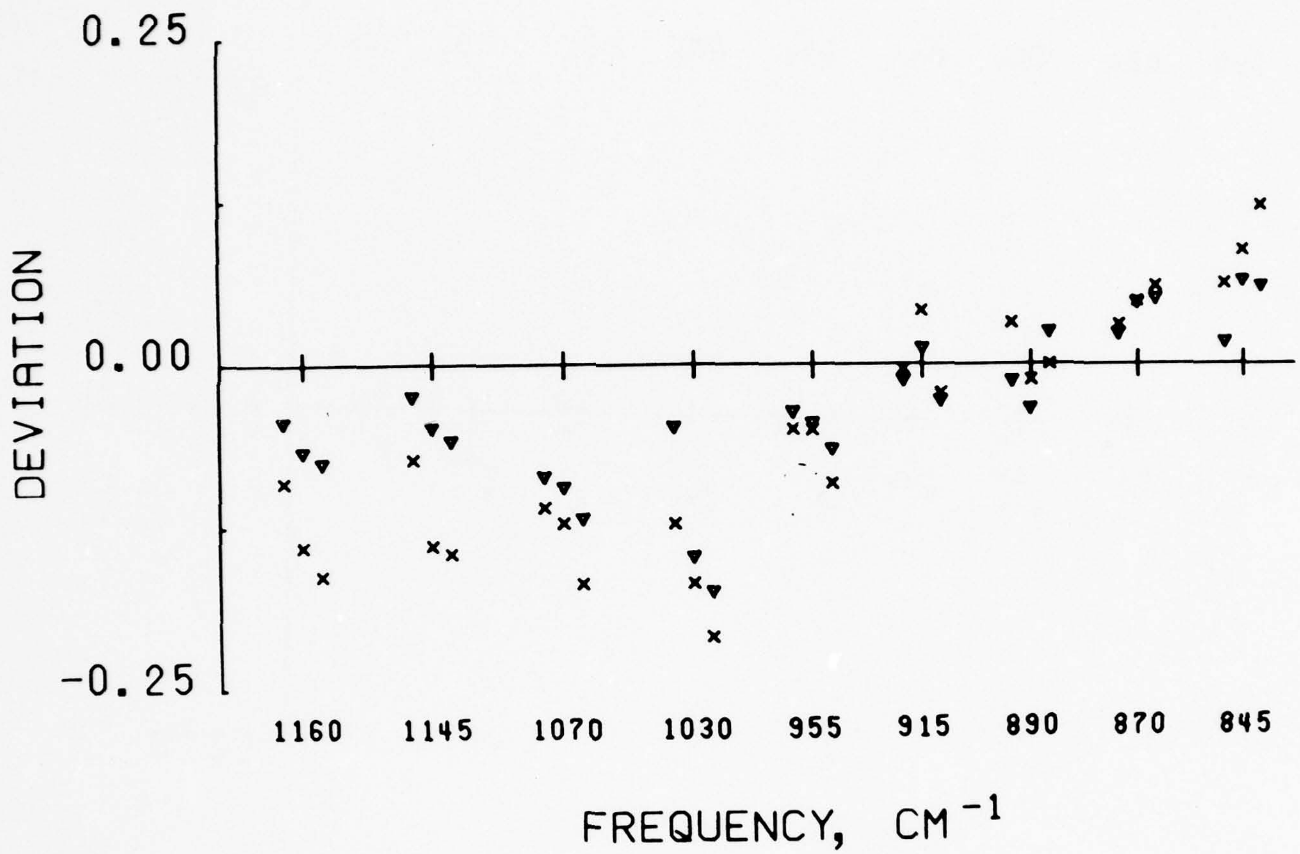

Figure 22-a. Bunker C fuel 613: 613101 (X), 613102 (X), 613103 (X), 613301 (∇), 613302 (∇), and 613303 (∇)

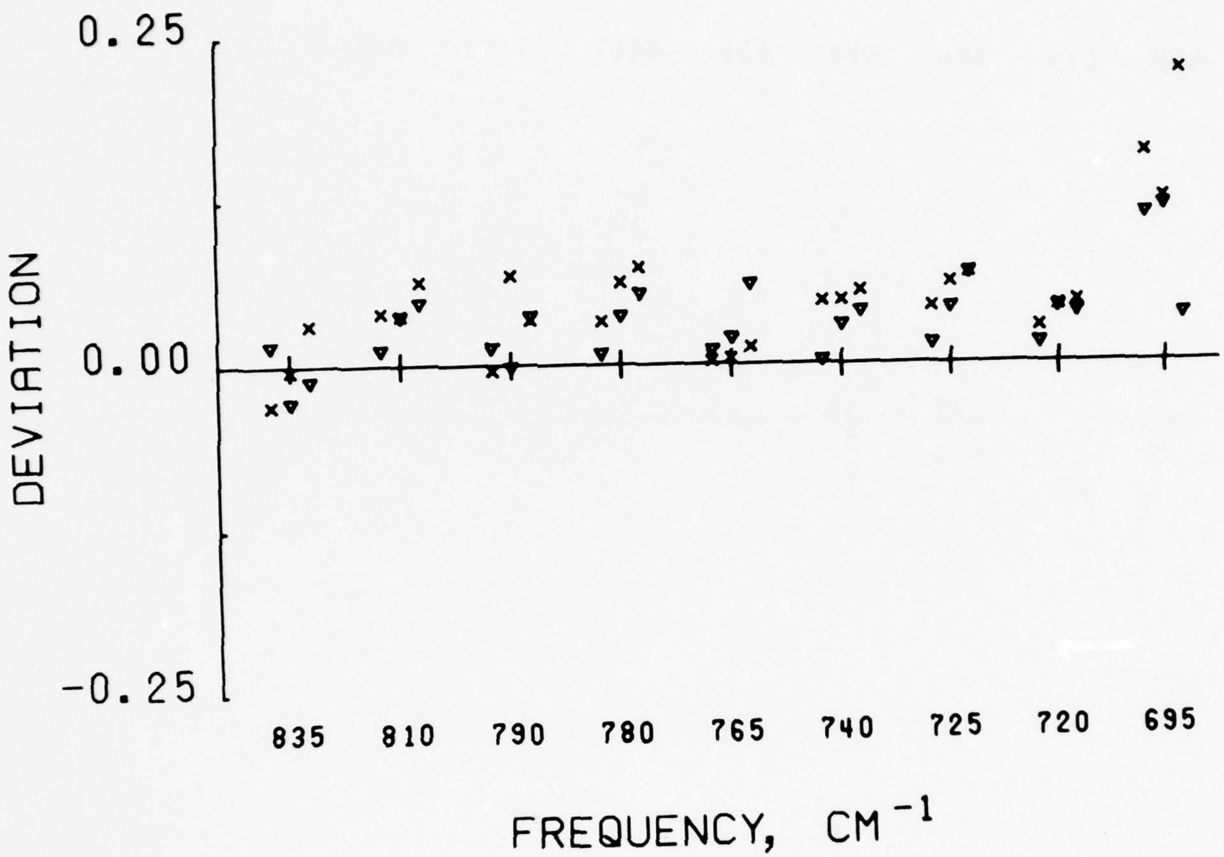

Figure 22-b. Continuation of Figure 22-a

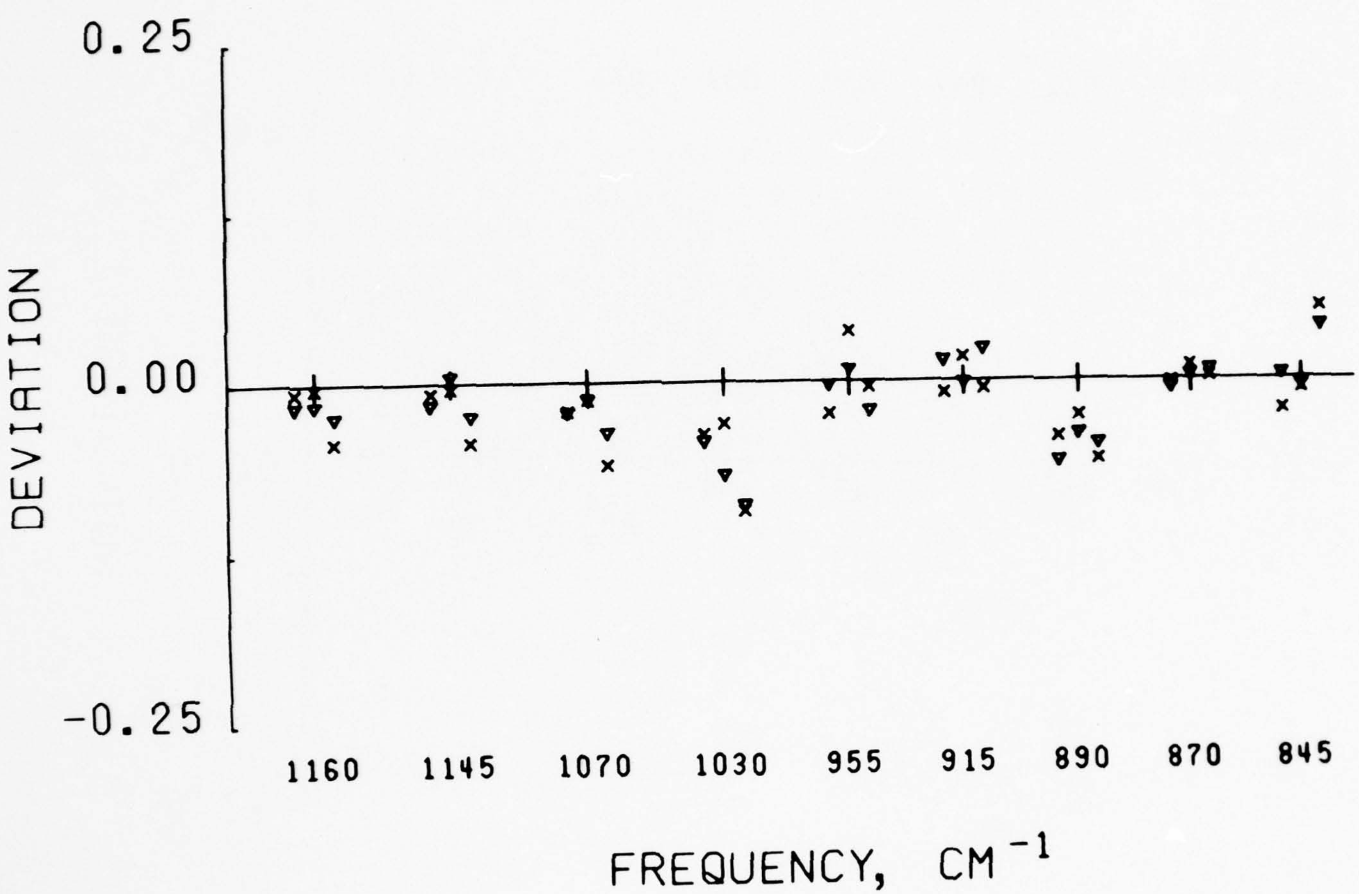

Figure 23-a. No. 6 fuel 622: 622451 (X), 622452 (X), 622453 (X), 622381 (∇), 622382 (∇), and 622383 (∇)

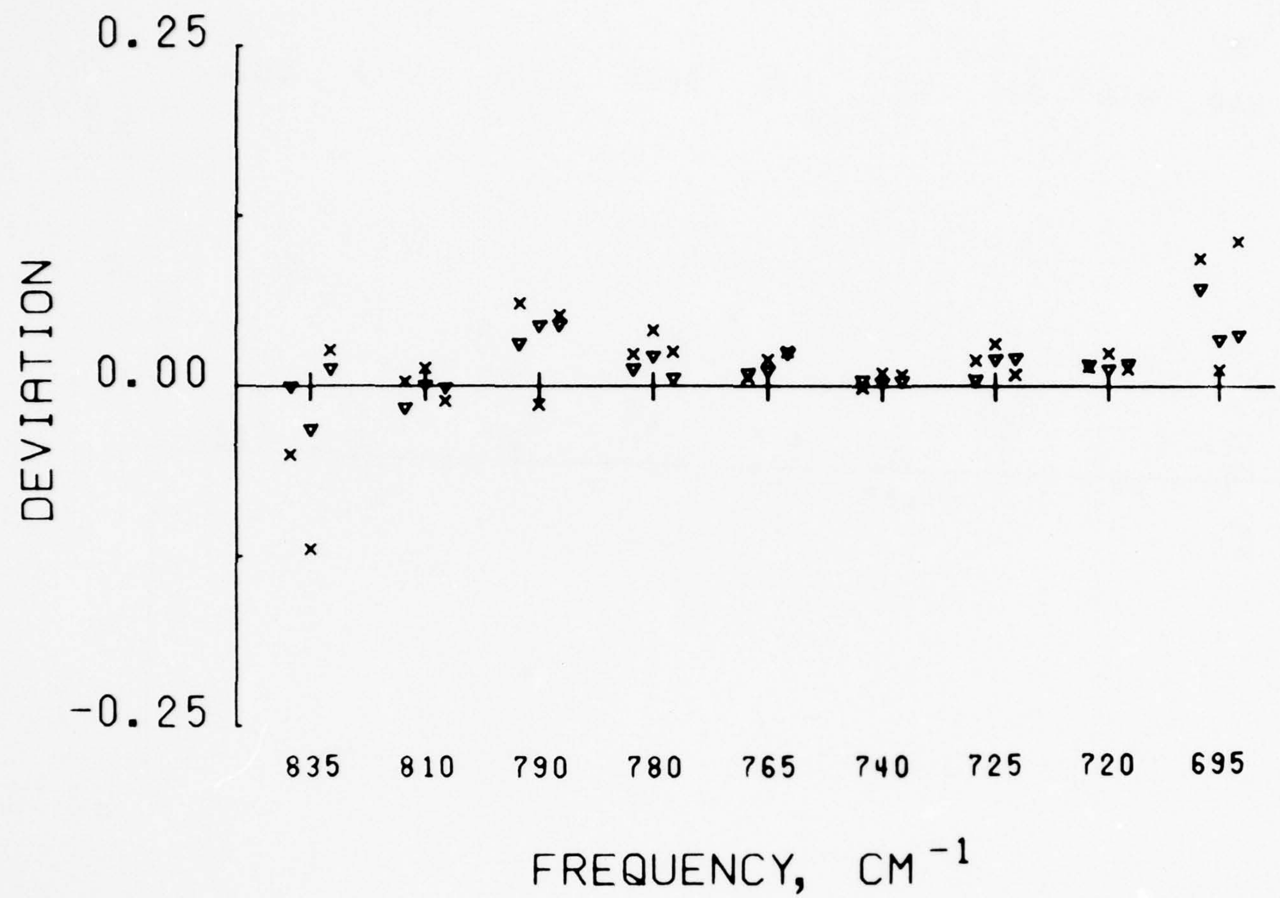

Figure 23-b. Continuation of Figure 23-a

IV-B-3. Comparison of Grids With Actual Weathering

To test the capability of the weathering grids to simulate actual conditions we have compared spectra of oil samples taken from an actual spill with those of the same oil weathered in our grids. On October 10, 1974, the tanker, Messiniaki Bergan, spilled 100,000 gallons of No. 6 fuel oil into New Haven Harbor. We obtained a large sample from the tanker and samples from the spill after 1 and 6 days. The oil from the tanker was weathered in the grids during the same time in order to match conditions as closely as possible.

Infrared spectra of the unweathered oil and oil from the spill are shown in Figure 24. Even though this was a heavy oil its spectrum did change upon weathering; thus, it was a good test for the weathering grids.

Spectra of the New Haven spill samples are compared to the original oil and to those weathered in our grids in Table III, where the number of normalized log-ratios within 0.04 (10%) of the average are given. It is seen that the spectra of the spill samples did change from the original; however, they compared extremely well with the spectra of the samples weathered in our grids indicating that artificial conditions give a reasonable simulation of an actual spill.

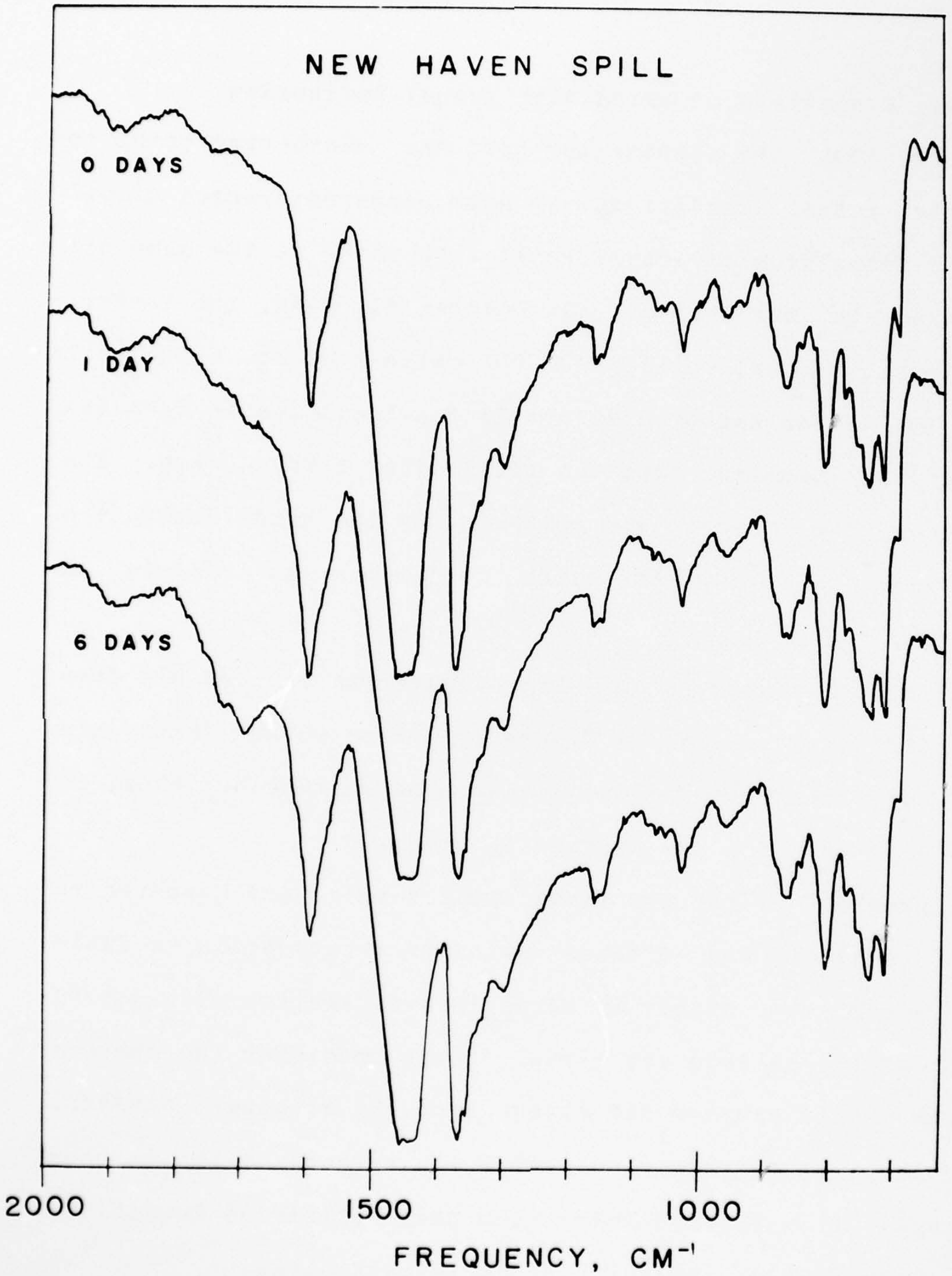

Figure 24. Infrared spectra of oil from New Haven spill: unweathered oil, weathered 1 day, and weathered 6 days

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IDENTIFICATION OF OIL SLICKS BY INFRARED SPECTROSCOPY.(U)
AUG 76 C W BROWN, P F LYNCH , M AHMADJIAN   DOT-CG-81-74-1099

UNCLASSIFIED   USCG-D-19-77   NL

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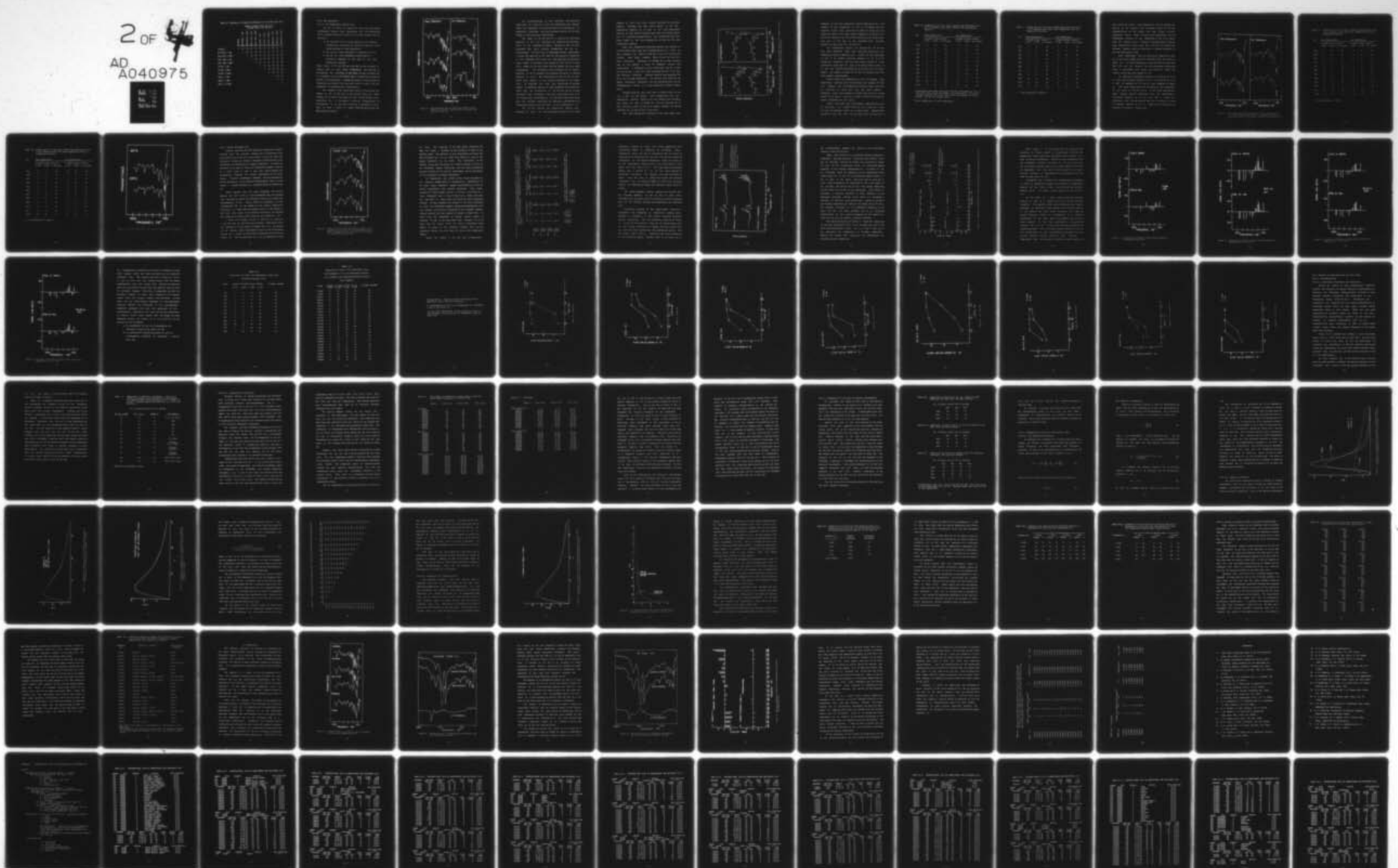


TABLE III. Comparison of Original and Weathered Oils from New Haven Spill

Number of Bands within 10% (0.04) -
18 Bands used in the Analysis

	Original	New Haven, 1 day	New Haven, 6 days	Narr. Bay, 1 day	Narr. Bay, 6 days	In-Lab, 1 day	In-Lab, 7 days	In-Lab, 14 days	Aquarium, 1 day	Aquarium, 7 days	Aquarium, 14 days
Original	--	14	13	13	12	18	15	12	18	12	8
New Haven, 1 day		--	18	17	17	16	17	17	14	16	13
New Haven, 6 days			--	16	18	14	16	16	14	16	16
Narr. Bay, 1 day				--	18	17	18	18	16	17	16
Narr. Bay, 6 days					--	15	17	17	13	16	18
In-Lab, 1 day						--	17	16	18	16	12
In-Lab, 7 days							--	18	15	18	16
In-Lab, 14 days								--	13	17	18
Aquar., 1 day									--	15	10
Aquar., 7 days										--	17
Aquar., 14 days											--

IV-C. New Techniques

IV-C-1. Low Temperature Spectra (23)

As can be seen in Figure 25, there are three major differences between room temperature and low temperature (80 K) infrared spectra of oils in the region between 650 and 1200 cm^{-1}:

1) the 720 and 725 cm^{-1} bands appear as two distinct absorptions, increasing in intensity compared to the bands measured at room temperature
2) the 740 cm^{-1} band decreases in intensity at 80 K
3) the 890 cm^{-1} band decreases significantly in intensity compared to the band in the room temperature spectra.

Those bands at 720 and 725 cm^{-1} are due to the in-phase CH rocking mode of long chain n-paraffins. The increase in intensities and sharpness of the bands is most probably due to alignment of the n-paraffins into a crystalline structure similar to polyethylene. Instead of having a distribution of frequencies we observe only one band, which is split into two components by intermolecular interactions.

The changes in low temperature spectra cited above are common to all of the oils we have studied thus far. Other changes can be noted, but these are only characteristic for a particular oil. A distinctly different "fingerprint" is attributable to an oil whose spectrum is measured at 80 K; thus, we have a means of double identification with one spectroscopic method.

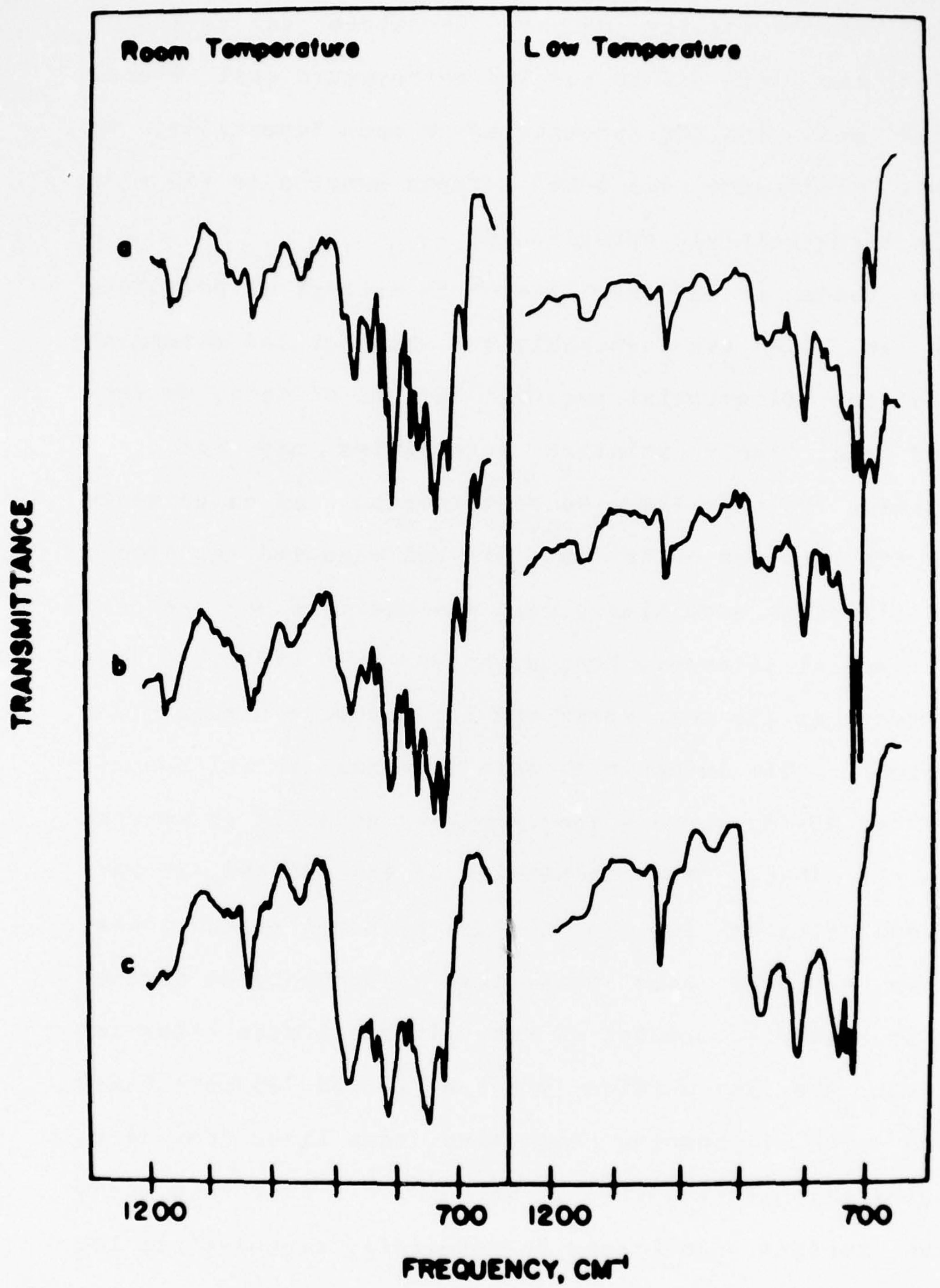


Figure 25. Room temperature and low temperature (80°K) infrared spectra of (a) a No. 2 fuel oil; (b) a crude oil; and (c) a No. 6 fuel oil

The reproducibility of the technique was tested by depositing the same oil in the low temperature cell several times and measuring its spectrum after each deposition. No measurable difference was noted between spectra of the same sample in these multiple experiments.

The bands at 720 and 725 cm^{-1} in spectra of petroleum measured at 80 K are generally the sharpest and strongest bands in the fingerprint region. Because of this, we were concerned that their relative intensities may not be reproducible. To test this, we performed several experiments in which the spectrum of the same oil was measured repeatedly at two different scan times, eg., the spectrum was measured eight times at alternate scan speeds of 16-6 and 32-10 (the first number is the scan speed and the second the scan speed suppression). The intensities were identical in all spectra measured at 32-10, whereas they deviated slightly in spectra measured at 16-6. The intensities of the 720 and 725 cm^{-1} bands were greater in the spectra measured at the longer time. We explored this scan time dependence on another sample by measuring spectra at many different scan times and found that the intensities of the 720 and 725 cm^{-1} bands increased with increasing scan time (scan times from 16 to 320 minutes were investigated). We concluded from this study that the optimum conditions for obtaining reproducible low temperature spectra are scan time = 32 and suppression = 10.

All of our initial low temperature spectra were measured at 16-6. We have remeasured spectra of the same

samples at 32-10 and they closely duplicate the original results. Applying the same ratio method to the low temperature spectra as we have to the room temperature spectra, we have matched unknown oils with the correct source oils by ratioing absorptivities. The comparisons were made using bands at the same frequencies as those for the room temperature spectra.

This low temperature infrared analysis was applied to the New Haven spill case that occurred during Oct., 1974. In this instance the source of the No. 6 fuel oil spilled was obvious. Many times, however, this is not the case in a spill situation. Therefore, to provide for a more rigorous test of the method, a group of "suspect" sources was constructed. It consisted of five crude oils, one No. 2 fuel oil and six No. 6 fuel oils (this included the No. 6 oil that was actually spilled). Infrared spectra were measured for each oil at room temperature. The spectra were coded in the manner previously described and the absorptivities for the "fingerprints" stored in a "room temperature suspect source file".

Samples from the real spill were collected after 24 hrs and 6 days on the water. Room temperature and low temperature infrared spectra for both samples were measured and these are seen in Figure 26. The top spectrum (a) in each section is that of the 24 hr sample, whereas the bottom spectrum (b) is that of the 6 day spill.

The room temperature fingerprints for each sample were

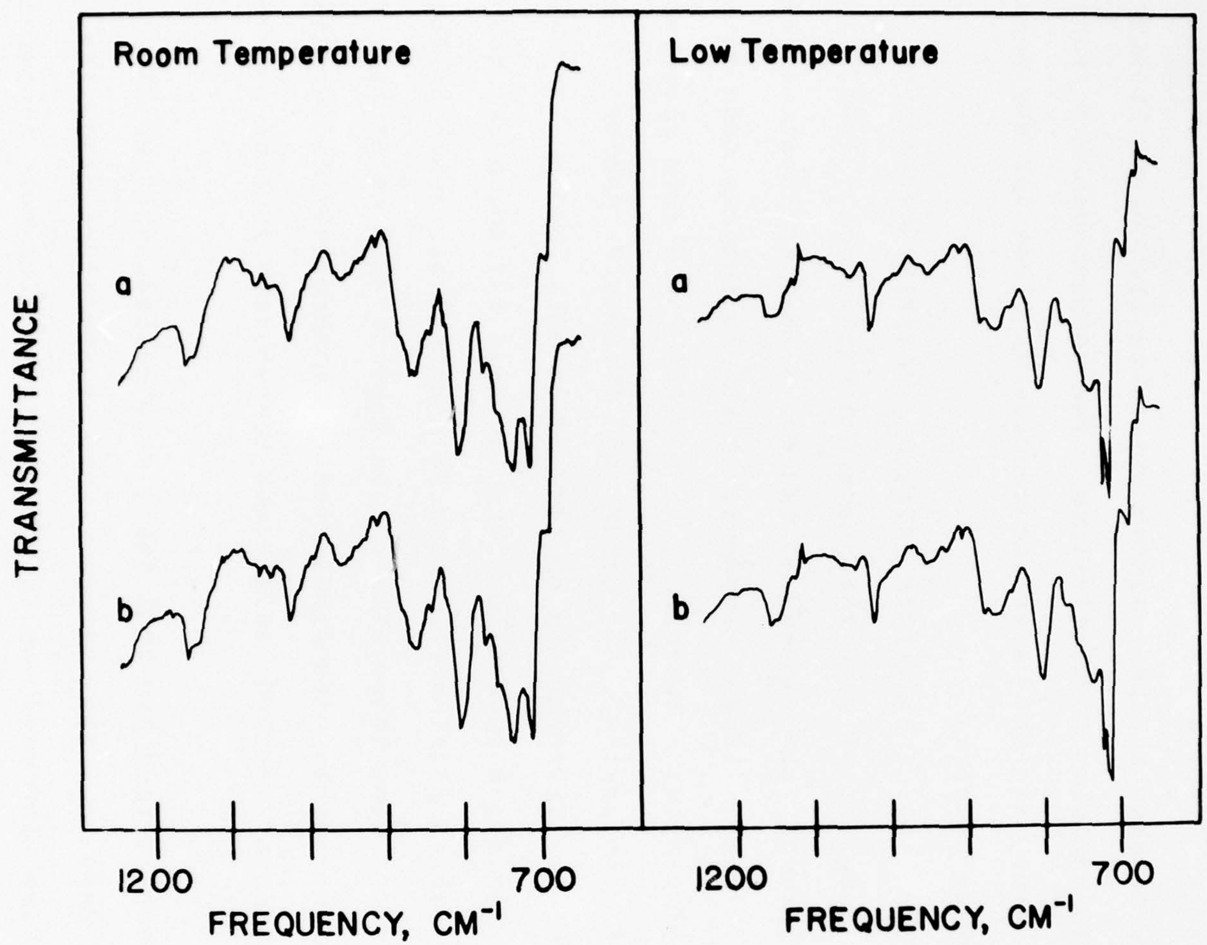


Figure 26. Room temperature and low temperature (80°K) infrared spectra of (a), sample collected 24 hours after spill and (b) sample collected 6 days after spill

compared to the room temperature source reference file. The results of the comparison of the 24 hr sample with all possible source oils are given in Table IV, which list the number of bands in the spill sample comparing to within 0.025 and 0.040 (within 5 and 10% of the average) of an ideal match with each of the oils in the reference file. The best matches are made with 901, 910 and 911.

Low temperature spectra of samples 901, 910 and 911 were then measured, coded and these data stored in a low temperature source reference file. Results of the comparison of the 24 hr sample spectrum measured at 80 K to its respective reference file are also shown in Table IV. This correlation shows that 911, with 14/16 bands within 0.040, to be the only sample continuing to match well with the spill sample. The number of bands of 901 and 910 matching with the spill dropped considerably.

Table V shows the comparison of the 6 day sample. Room temperature analysis gives best matches with samples 910 and 911. However, the low temperature analysis shows that only 911 continues to match well with the spill sample. Therefore, from this evidence it would seem that 911 is the source of the spill. This is, in fact, the No 6 oil from the tanker responsible for the spill.

During this same time a municipally owned storage tank in Pawtucket, R.I. leaked 5,000 gal. of a light No. 6 fuel oil into the brackish waters of a nearby river. Samples were collected from the tank and the spill site (24 hrs and 11

Table IV. Comparison of 24 hr. spill sample from New Haven with 12 oil samples using both room and low temperature spectra.

No.	Room Temperature			Low Temperature		
	# bands within limits+			# bands within limits+		
	0.025	0.040	# ratioed	0.025	0.040	# ratioed
901*	5	11	16	3	4	15
902	4	6	16	2	4	14
903	2	2	16	4	9	16
904	1	2	13	0	2	11
905	4	6	14	5	8	11
906	0	3	10	3	3	10
907	1	4	16	9	10	16
908	2	8	15	7	8	16
909	3	5	16	1	3	16
910*	12	15	16	2	4	15
911*	9	12	16	8	14	16

+ Comparisons were made using the log-scale described in ref. 17. The 0.025 limit gives the number of ratios within 5% of the average, whereas the 0.040 limit gives the number of ratios within 10% of the average ratio.

* Best comparisons at room temperature.

Table V. Comparison of 6 day spill sample from New Haven with 12 oil samples using both room temperature and low temperature spectra.

No.	Room Temperature			Low Temperature		
	# bands within limits+			# bands within limits+		
	0.025	0.040	# ratioed	0.025	0.040	# ratioed
901	5	8	16	1	3	15
902	6	7	16	4	5	14
903	1	3	16	9	10	16
904	1	1	13	1	2	11
905	3	4	14	1	3	11
906	1	1	10	3	3	10
907	1	2	16	2	3	16
908	4	5	15	6	7	16
909	3	4	16	1	3	16
910*	8	14	16	2	3	15
911*	6	11	16	9	11	16

+, * see footnotes in Table I.

days after the spill). Room temperature and low temperature spectra of all samples were measured (Figure 27) and the absorptivities of the source oils were stored in their respective files. Table VI shows room temperature and low temperature results in the comparison of the 24 hr sample with the "source oils." Choices of possibilities from the room temperature study show 902, 910 and 912 giving best matches; however, only 912 continues to compare favorably in the low temperature study.

Room temperature and low temperature comparisons with the 11 day spill sample from the Pawtucket River are given in Table VII. At room temperature, best matches are made with 902, 910 and 912, whereas the low temperature comparison gives a consistent best match with only 912. Again, the correct source has been chosen as 912.

In addition to measuring spectra of petroleum at 80 K, we have also measured spectra at 20 K. The spectra of a No. 6 fuel oil measured at 80 K and 20 K are compared in Figure 28. The major differences are increases in the intensities of the bands at 720 and 725 cm at the lower temperature. These changes provide additional data for identifying petroleum; however, we do not feel that a couple of additional data values warrant the time and effort it takes to measure spectra at 20 K. Thus, we are confining our analysis to liquid N temperature.

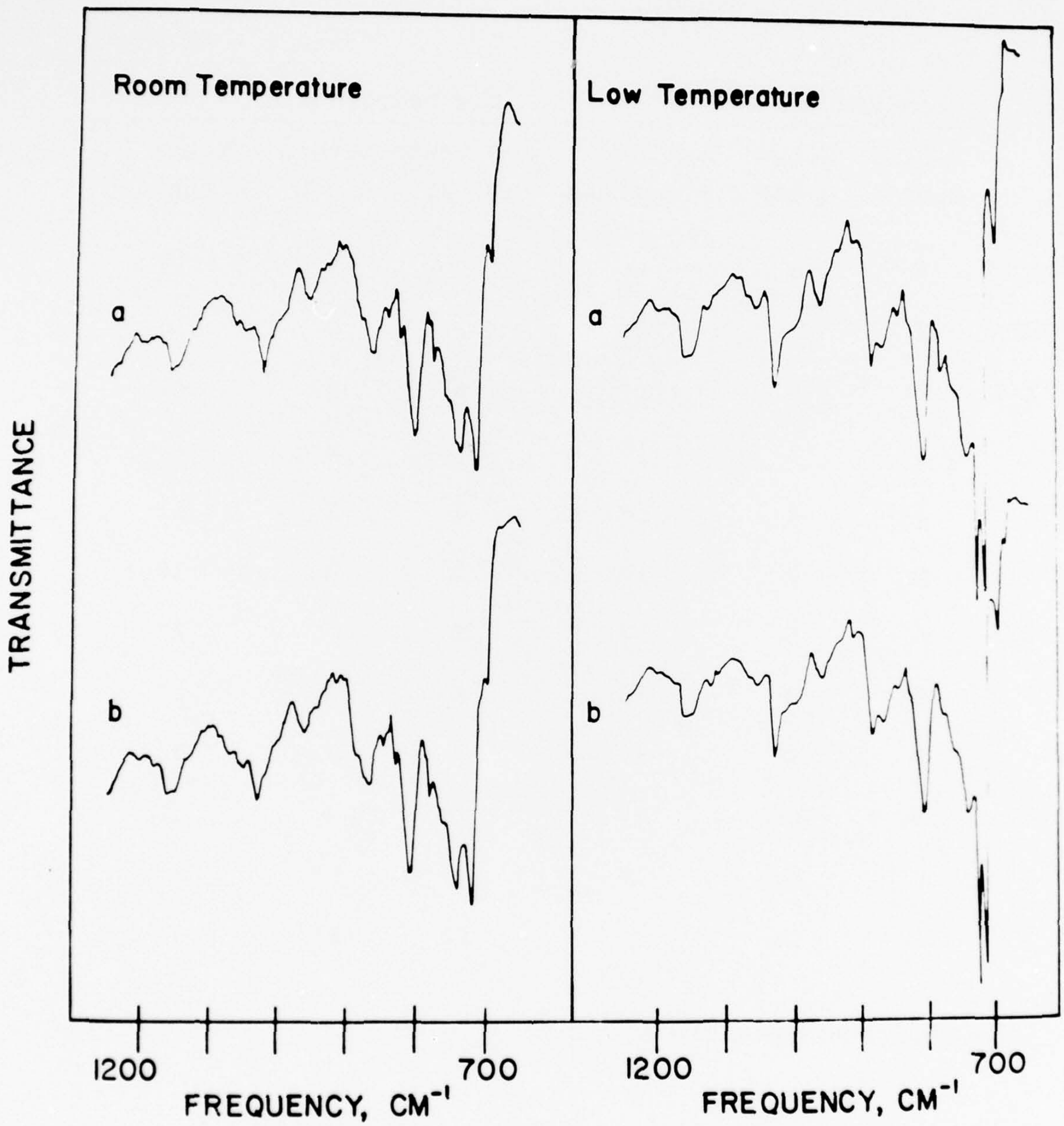


Figure 27. Room temperature and low temperature (80°K) infrared spectra of Pawtucket (Rhode Island) spill: (a) sample collected 24 hours after spill and (b) sample collected 11 days after spill

Table VI. Comparison of 24 hr. spill sample from Pawtucket with 13 oil samples using both room temperature and low temperature spectra.

No.	Room Temperature			Low Temperature		
	# bands within limits+			# bands within limits+		
	0.025	0.040	# ratioed	0.025	0.040	# ratioed
901	5	8	16	2	3	16
902*	7	10	17	2	6	15
903	3	4	17	6	9	17
904	1	1	13	1	2	12
905	4	5	14	2	2	11
906	0	0	10	3	3	10
907	5	6	17	9	11	17
908	5	8	16	6	7	17
909	3	4	17	1	1	17
910*	9	13	17	0	4	16
911	6	9	16	9	12	17
912*	11	12	17	12	14	17

+, * see footnotes in Table I.

Table VII. Comparison of 11 day spill sample from Pawtucket with 13 oil samples using both room temperature and low temperature spectra.

No.	Room Temperature			Low Temperature		
	# bands within limits+			# bands within limits+		
	0.025	0.040	# ratioed	0.025	0.040	# ratioed
901	4	7	16	8	12	16
902*	9	9	17	1	4	15
903	4	4	17	7	9	17
904	0	1	13	2	2	12
905	4	5	14	3	4	11
906	0	1	10	3	3	10
907	5	6	17	5	9	17
908	7	8	16	5	5	17
909	4	4	17	2	2	17
910*	8	13	17	0	2	16
911	6	9	16	8	8	17
912*	12	14	17	9	11	17

+, * see footnotes in Table I.

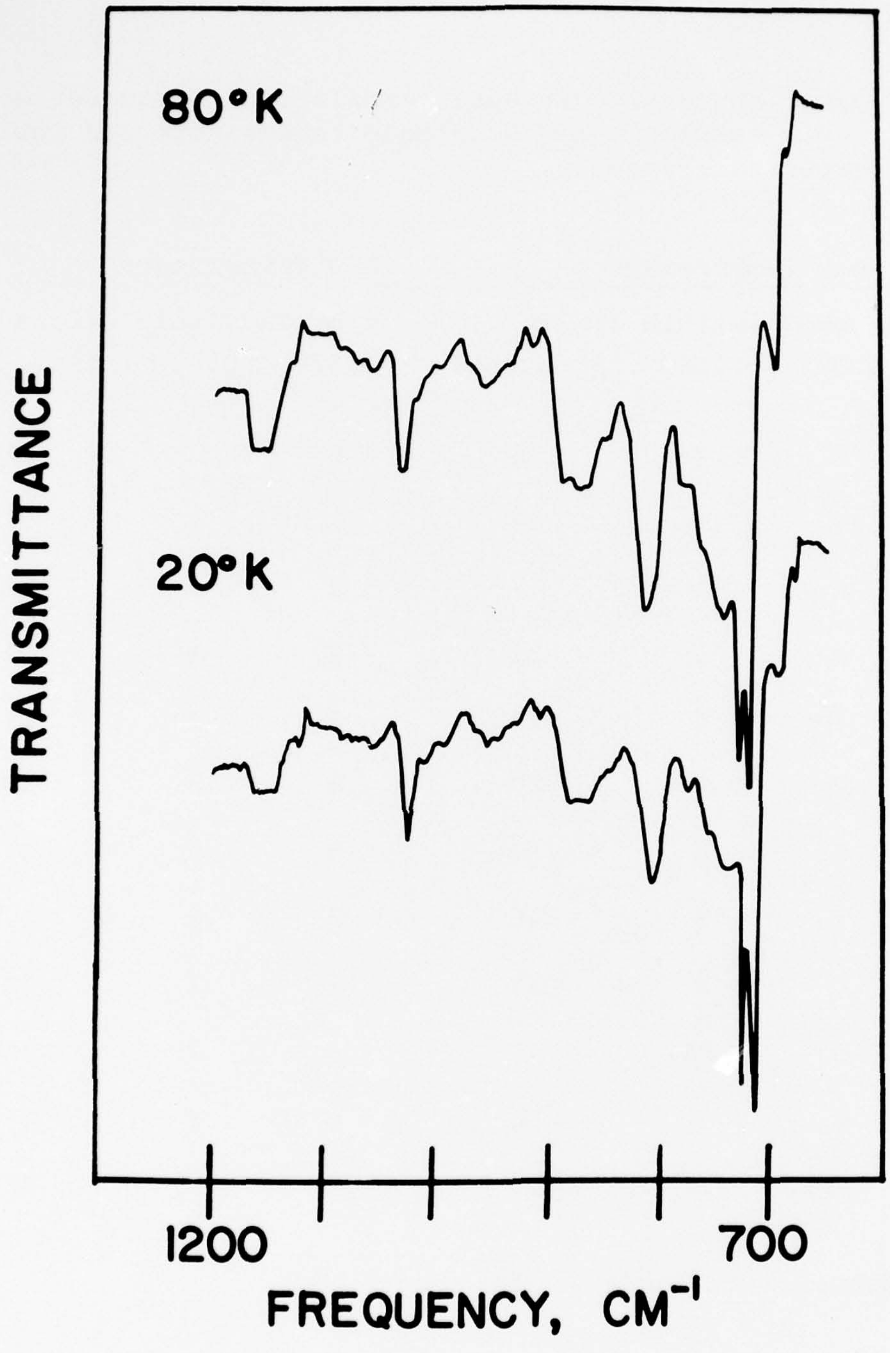


Figure 28. Infrared spectrum of a No. 6 fuel oil measured at 80°K and 20°K

IV-C-2. Vacuum Treatment (24)

Results from the Bay and laboratory weathering studies indicate that the greatest changes due to weathering take place within the first 48-72 hours after a spill and that the remaining changes are gradual, involving oxidation more than dissolution or evaporation of sample components. It would be desirable to be able to treat the unweathered suspect sources in a spill case in such a way that would quickly and conveniently simulate the natural weathering of the spill sample. Volatile components normally lost by evaporation during weathering can be removed by evacuation; thus, we have tested a vacuum treatment as a possible means of weathering oil.

After several oils had been evacuated for periods between 0.5 and 24 hrs, it was determined that the minimum time required to remove the volatiles from an oil sample was approximately 18 hrs. When a sample is evacuated, it cools considerably due to the removal of the lighter components. Therefore, we found that by warming (35-40 C) the sample in the test tube prior to and during evacuation, the maximum time required to remove most volatiles was reduced to 1 hr.

A total of 16 crudes, one No. 2, three No. 5, seven No. 6 and one lube oil (all were the original, unweathered oils) was subjected to the vacuum treatment for 1 hr. An example of the changes which consistently occur in the fingerprint region as a result of this vacuum treatment can be seen in Figure 29. The top spectrum (a) is of an unweathered crude

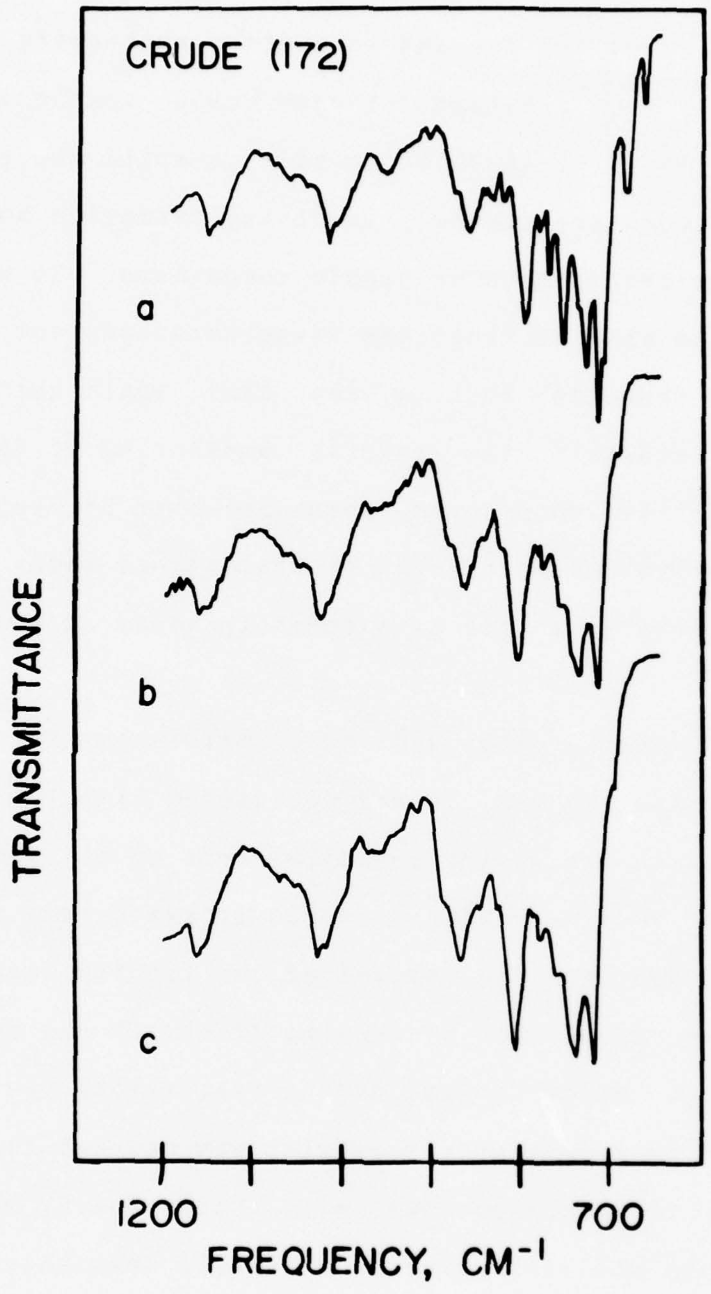


Figure 29. Infrared spectra in the 650-1200 cm-1 region of: (a) unweathered (172) crude; (b) crude weathered 7 days; and (c) unweathered crude which had been evacuated at 35°C and $5X10^{-2}$ Torr for 1 hour

oil (172). The spectrum of the same sample weathered one week (b) shows a decrease in the intensity of many of the sharper bands. The spectrum of the unweathered oil which has been evacuated for 1 hr (c) looks very similar to that of the sample weathered for one week. The intensities of the sharper bands have decreased in a similar manner to those in the weathered sample indicating that the major weathering process occuring in the natural environment can be reproduced in the laboratory by sample evacuation.

To demonstrate the effect of the vacuum treatment on the computer comparisons of a weathered vs. unweathered oil we chose three weathered samples corresponding to each of twelve unweathered oils already evacuated. This group consisted of five crudes, one No. 2, two No. 5 and four No. 6 fuels weathered for 2, 7 and 14 days each. These oils were all evacuated to insure that the volatiles were completely removed. We then compared the results by the ratio technique on both the unvacuumed samples (unweathered/weathered) with the results by the ratio technique on the vacuumed samples. Typical results for four samples are shown in Table VIII. In every case the comparison of vacuum treated sample is superior to that of the unvacuumed oils. However, as can be seen from the table, there are still a relatively large number of bands in the weathered samples that are not comparing within the 0.04 limit to those of the unweathered sample.

During the course of the Bay and in-laboratory

TABLE VIII. Comparison of Results by the Ratio Method on Original vs Weathered, *Vacuumed Original* vs Vacuumed Weathered and Sea Water-Vacuum Original vs Vacuumed Weathered. Bands Within Limits of 5 and 10% Are Listed.

		Orig. vs. Weathered			Vac. Orig. vs. Vac. Weathered			Sea Water & Vac. Orig. vs. Vac. Weathered		
		.025	.040	# bands	.025	.040	# bands	.025	.040	# bands
172	301	3	6	18	10	17	18	16	17	18
	302	3	5	18	7	11	18	9	15	18
	303	4	6	18	8	10	18	12	15	18
417	301	5	6	17	14	15	17	11	16	17
	302	2	2	17	3	3	17	4	10	17
	303	2	3	17	1	3	17	1	3	17
618	301	7	8	17	3	8	17	9	12	17
	302	2	6	17	2	3	17	8	13	17
	303	2	2	17	1	4	17	4	11	17
617	401	11	13	18	5	10	18	13	18	18
	402	6	7	18	5	8	18	14	17	18
	403	3	5	18	3	7	18	3	7	18

172 - crude
417 - #4 f.o.
618 - #5 f.o.
617 - #6 f.o.

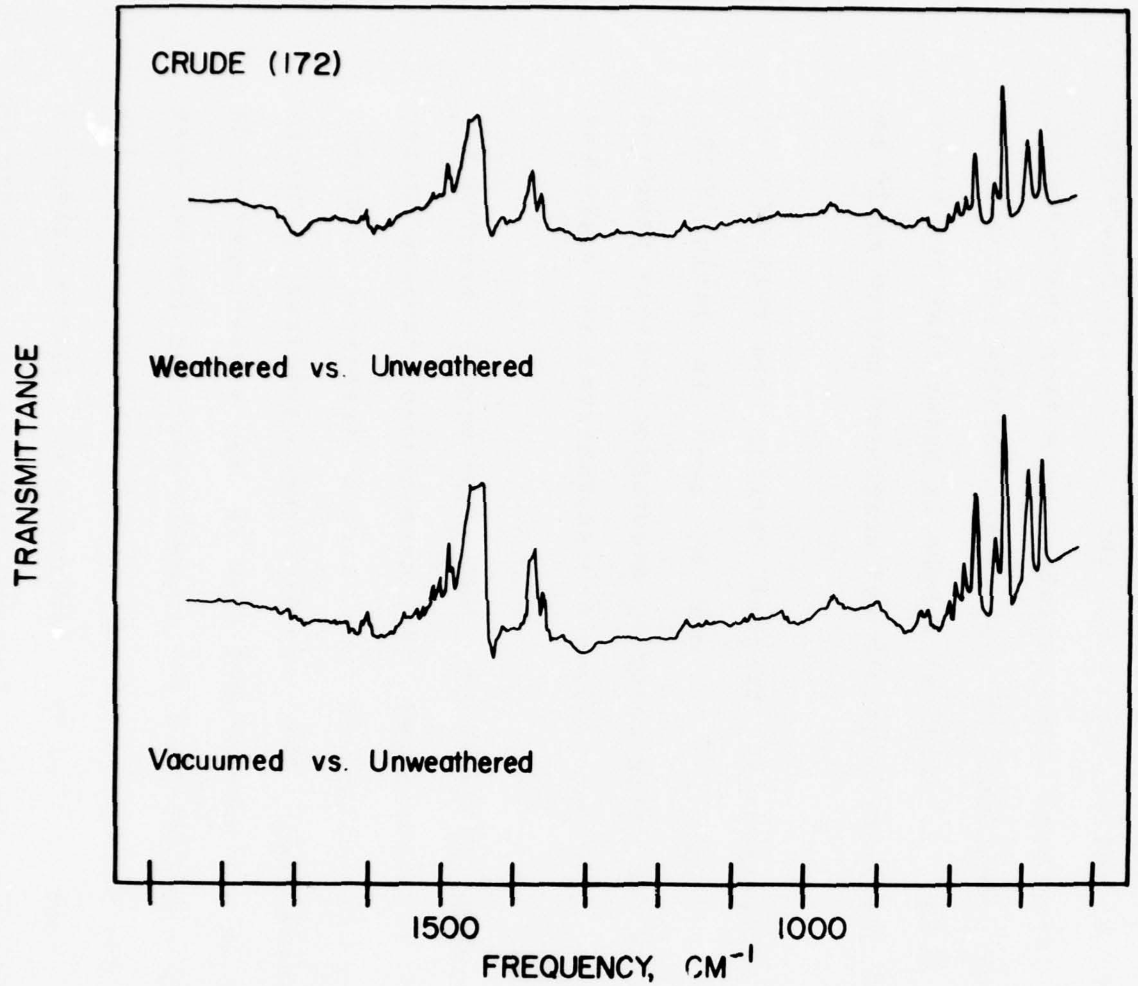
In each set of weathered samples, the last 2 digits denote the following weathering periods:

01 - 2 days
02 - 7 days
03 - 14 days

weathering studies we found that water temperature had a significant effect on weathering of petroleum. Water temperature would not only be responsible for the degree of evaporation of volatiles from the oil, but also the degree of dissolution of the soluble components. Thus, we placed all of the unweathered samples used in the above study in test tubes with sea water at 35 C. The tubes were periodically shaken over a period of 1 hr and the water removed as previously described. The samples were then evacuated as above. This was done to remove the soluble and volatile components from the original sample in order that the match between the unweathered sample and weathered sample would be closer.

The water-vacuumed treated samples were ratioed with the vacuumed samples. As can be seen in Table VIII, treatment with sea water prior to evacuation greatly improved most of the matches between the unweathered and weathered oils.

Difference spectra of sea water-vacuum treated vs. unweathered and weathered vs. unweathered samples were measured to determine if the vacuum treatment simulated natural weathering. The top difference spectrum in Figure 30 is for an oil weathered 2 days vs. the unweathered crude and the bottom spectrum for a sample that was treated with sea water and then vacuumed vs. the unweathered sample. The very weak band at 1700 cm indicates very little oxidation in the weathered sample. However, there is an almost one to



TOP - crude (172) weathered 2 days in marine environment

BOTTOM - unweathered crude which had been treated with warm (35°C) $NaCl/H_2O$ and evacuated at 35°C and $5X10^{-2}$ Torr for 1 hour

Figure 30. Infrared difference spectra in the 1900-650 cm-1 region

one correspondence between the spectra in the fingerprint region of 1250 and 650 cm^{-1}.

These same results can be obtained without measuring a difference spectrum directly. Using the ratio method a plot can be obtained showing the degree and direction of change for each of the fingerprint bands of a weathered sample compared to the original unweathered oil. In Figure 31 the top histogram shows the comparison of the unweathered crude (from Figure 29) to each of its weathered samples after 2, 7 and 14 days on the water. The first line in each set of three lines represents the comparison of the 2 day sample to the original, the second line is the 7 day sample comparison and the third line is the 14 day comparison. Lines below 0.0 represent a relative increase in band intensity in the weathered spectrum, whereas lines above 0.0 represent a decrease in relative band intensities. Losses in volatile and soluble components are shown by the bands below 810 cm^{-1}. The apparent increases in the components absorbing at and above 810 cm^{-1} are most probably due to an increased concentration of the heavier components in the sample as a result of the loss of lighter, soluble fractions.

The bottom histogram in Figure 31 shows the comparison of the same unweathered crude to the vacuumed and also to the water-treated/vacuumed crude. The first line in each set of two represents the unweathered vs vacuumed comparison, whereas the second line represents the unweathered vs. vacuumed-treated comparison.

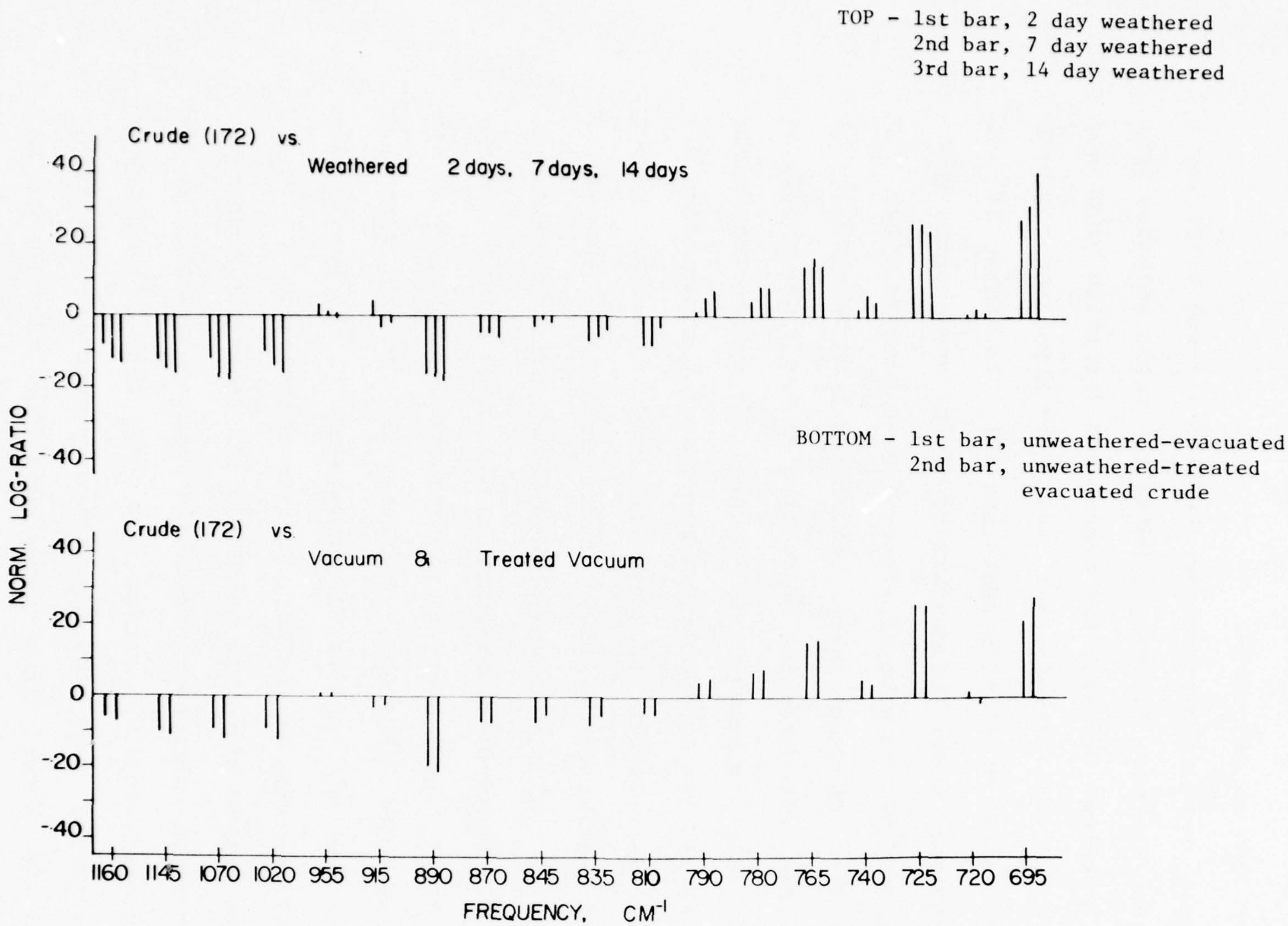


Figure 31. Histogram in 650-1200 cm-1 region showing comparison of unweathered crude (172)

From Figure 31 it is evident that the magnitude and direction of change caused by artificially treating the unweathered crude duplicates that which occurs during 2 to 7 days of natural weathering. Comparing these histograms with the difference spectrum in Figure 30, it can be seen that the two figures display spectra which show identical decrease in components that give rise to bands below 810 cm^{-1} and a relative increase in concentration of components that give rise to bands above 810 cm^{-1}.

Histograms were obtained for comparisons of weathered (2 days) vs. unweathered samples and treated vs. unweathered samples for the other 11 oils. Four of these are shown in Figures 32-35. All showed results similar to the crude No. 172.

In the event of a spill, samples from all possible sources as well as a sample of the spill itself would be collected. The question might arise concerning the possible ambiguity of matching a spill sample to the correct source, if all samples had been first evacuated, i.e., does the vacuum technique reduce the "uniqueness" of a sample's fingerprint to the point where it resembles that of every other suspect? To test this possibility, we placed the spectral data of all 12 oils which had been evacuated and treated-evacuated into a "suspect source" reference file and the fingerprints of the corresponding untreated oils into another "suspect source" reference file. Parallel comparisons were made between an untreated spill sample and

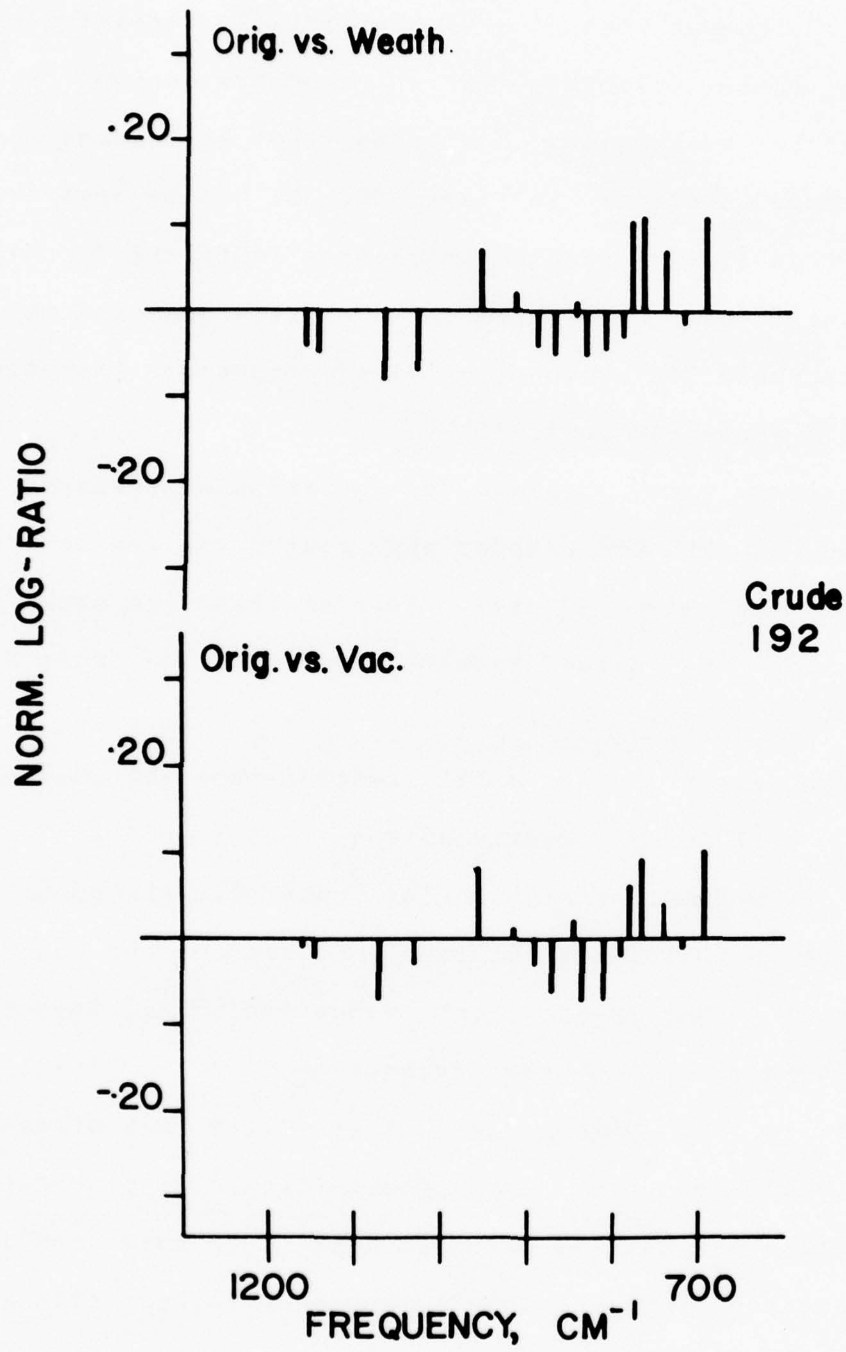


Figure 32. Histogram in 650-1200 cm-1 region showing comparison of unweathered crude (192)

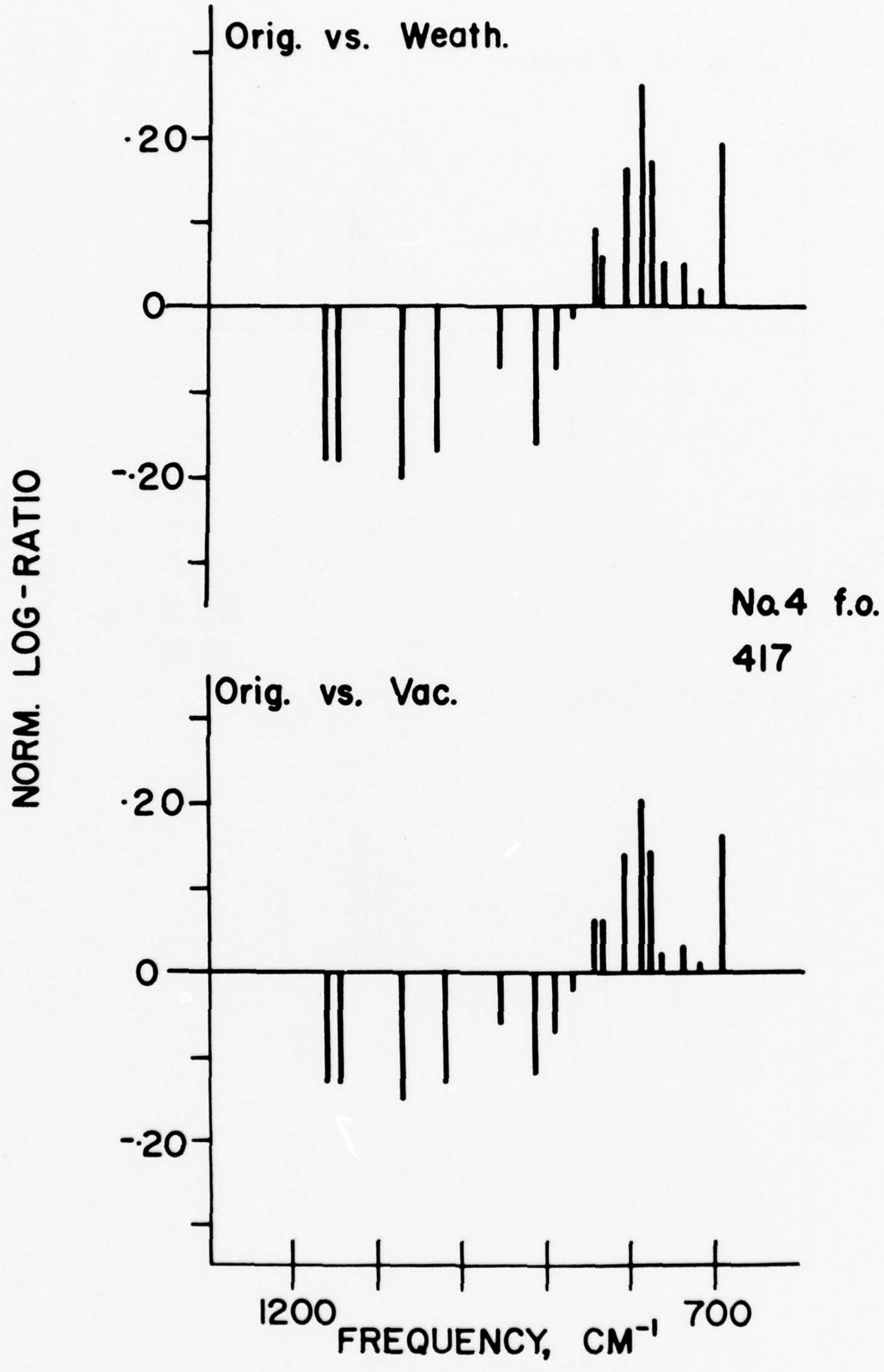


Figure 33. Histogram in 650-1200 cm-1 region showing comparison of unweathered No. 4 fuel (417)

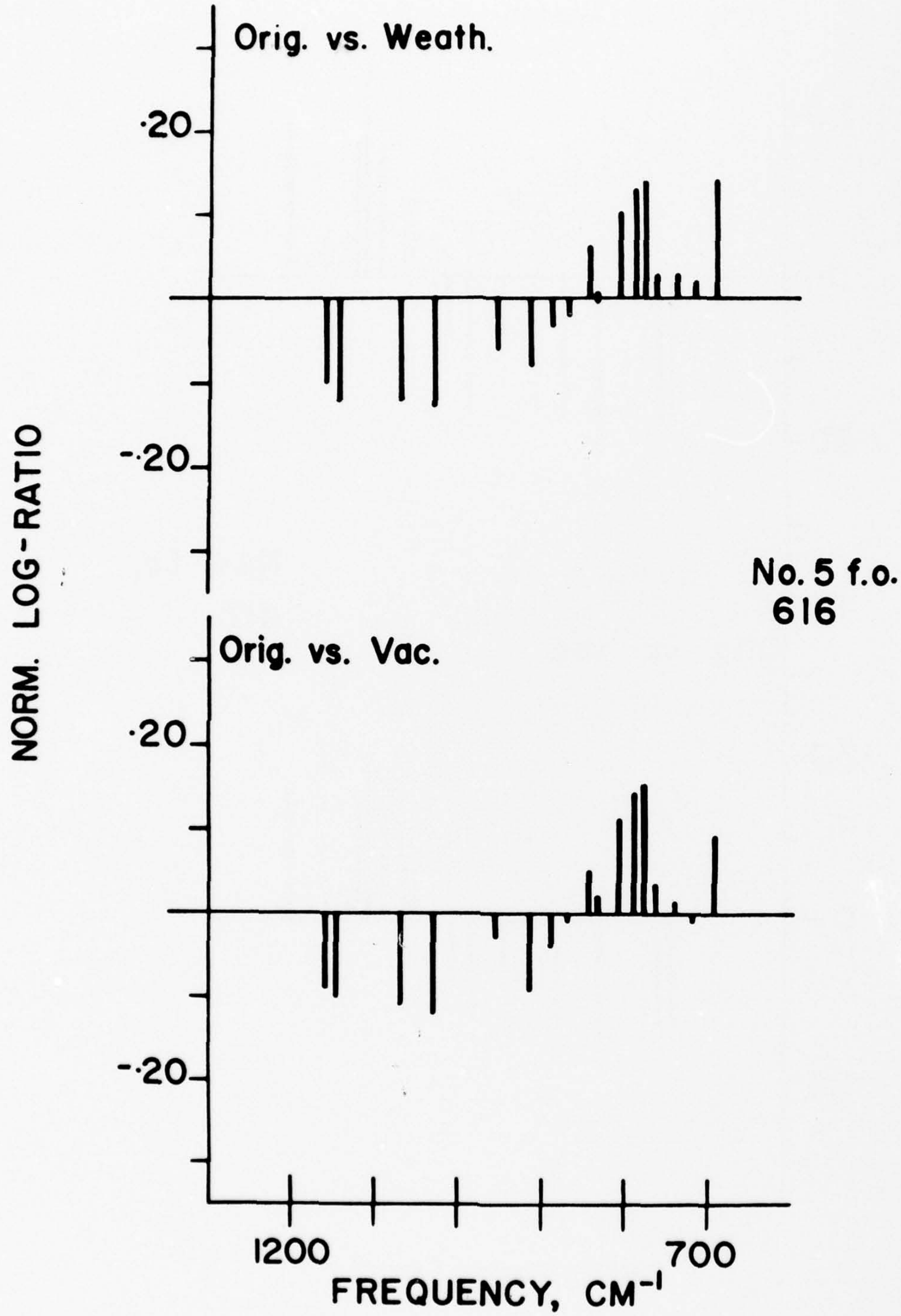


Figure 34. Histogram in 650-1200 cm-1 region showing comparison of unweathered No. 5 fuel (616)

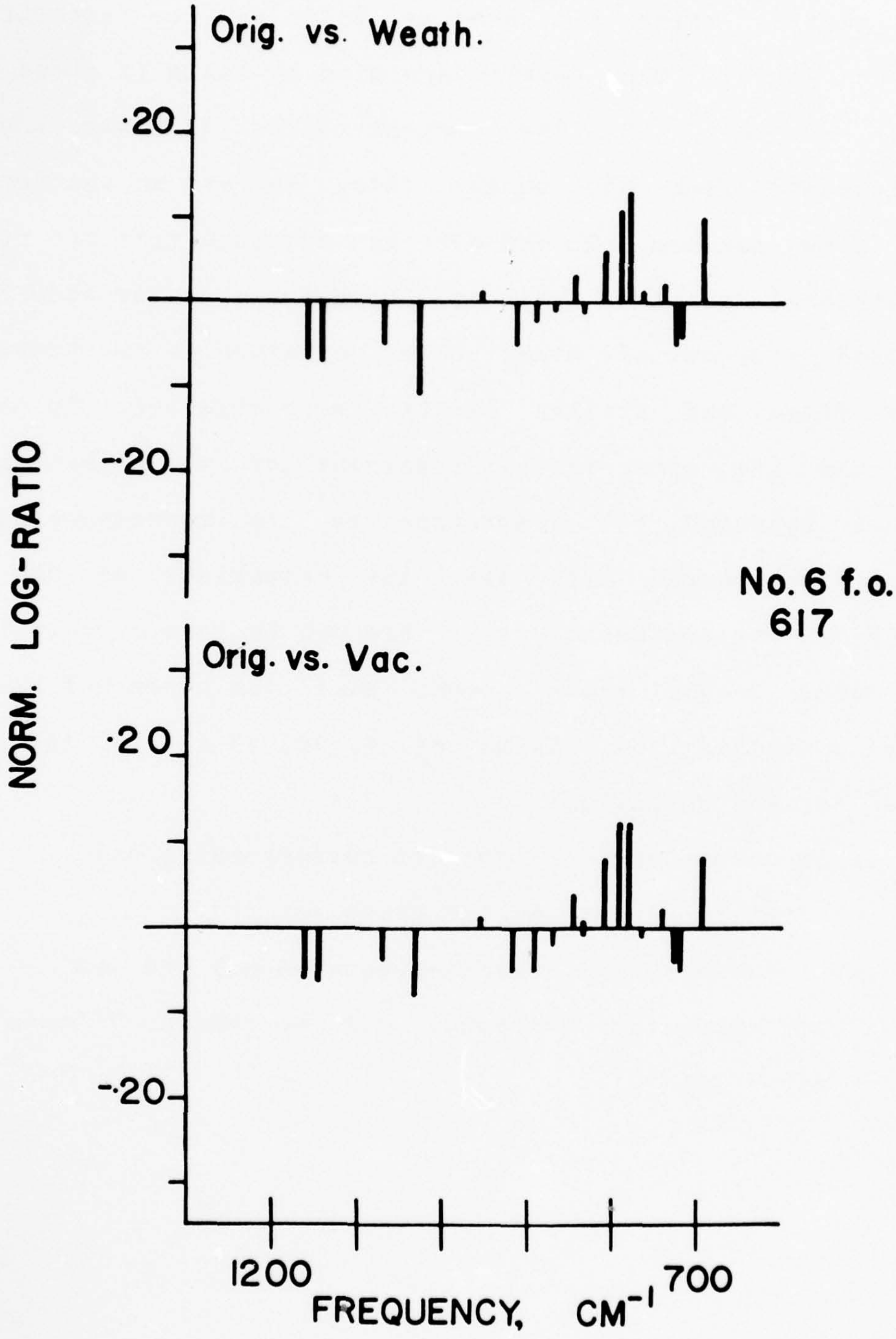


Figure 35. Histogram in 650-1200 cm-1 region showing comparison of unweathered No. 6 fuel (617)

its corresponding reference file as well as between the same spill sample, which had been evacuated and its respective reference file. The results are give in Table IX a and b. It can be seen that the correct source (172) was chosen unambiguously from the vacuum file, whereas an incorrect match to two sources (622 and 626) was obtained from the file of untreated samples. This type of comparison was made for weathered samples of other oils contained in the suspect source files and similar results were obtained. In each case, the sea water/vacuum treatment of the unweathered original improved the comparison to its corresponding evacuated weathered oils over the comparison of the unweathered vs. weathered oils. This can be seen graphically in Figures 36-43; these graphs plot the number of bands comparing within the limits of 5, 10, 25 and 50, and are plotted for the following:

i) an unweathered oil and its corresponding oil weathered 2 days on the water (o) and

ii) an unweathered treated-evacuated oil and its corresponding evacuated oil weathered 2 days on water (Δ)

TABLE IXa

Comparison of Crude (172) Weathered 2 days with

Untreated Original Oils

Knum	Number of bands within limits				# bands ratioed
	0.025	0.040	0.100	0.150	
172	3	6	11	15	18
188	2	3	13	16	18
191	1	4	9	13	18
192	3	4	9	13	18
213	2	4	10	14	18
417	2	2	7	9	18
616	0	1	5	10	17
617	2	2	6	14	18
618	0	1	4	8	18
622	10	11	18	18	18
623	5	6	15	16	17
626	7	14	18	18	18

TABLE IXb

Comparison of Crude (172) Weathered 2 Days and Evacuated 1 hr. with Evacuated Original Oils (XXXOOO) and Treated-Evacuated Original Oils (XXX900)

Knumb	Number of bands within limits 0.025	0.040	0.100	0.150	# bands ratioed
172000	6	14	18	18	18
172900	13	15	18	18	18
188000	9	12	18	18	18
188900	10	13	18	18	18
191000	3	6	15	17	17
191900	3	4	15	17	17
192000	4	8	12	16	17
192900	4	8	12	16	17
213000	4	5	12	15	18
213900	5	6	13	15	18
417000	3	5	11	17	17
417900	4	8	16	17	17
616000	2	4	13	18	18
616900	4	4	13	17	17
617000	0	2	11	18	18
617900	1	5	13	17	18
618000	1	1	5	12	17
618900	2	4	11	15	17
622000	9	15	17	18	18
622900	6	12	18	18	18
623000	4	8	14	16	17
623900	5	7	15	16	17
626000	7	13	18	18	18
626900	8	11	18	18	18

Figures 36-43. Number of ratios comparing within specified limits for the following:

i) unweathered oil and its corresponding oil weathered 2 day on the water (o)

ii) the same unweathered, vacuum-treated oil and its corresponding vacuum-treated oil weathered 2 days on water (Δ).

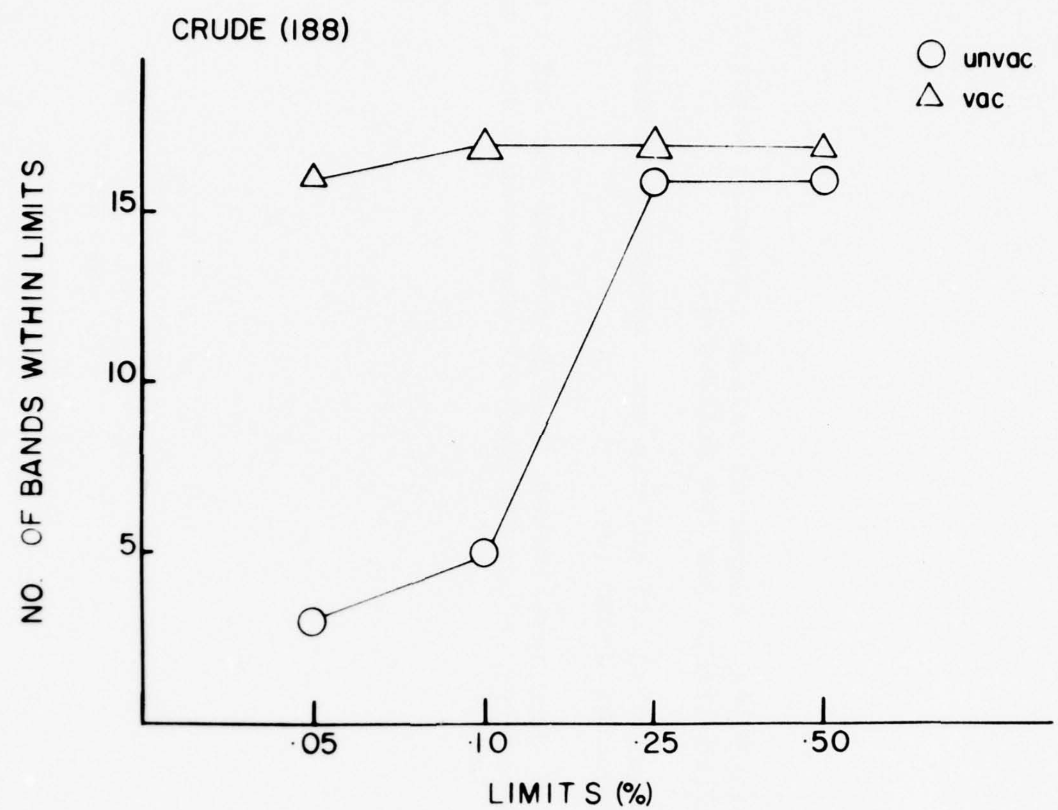


Figure 36. Crude 188

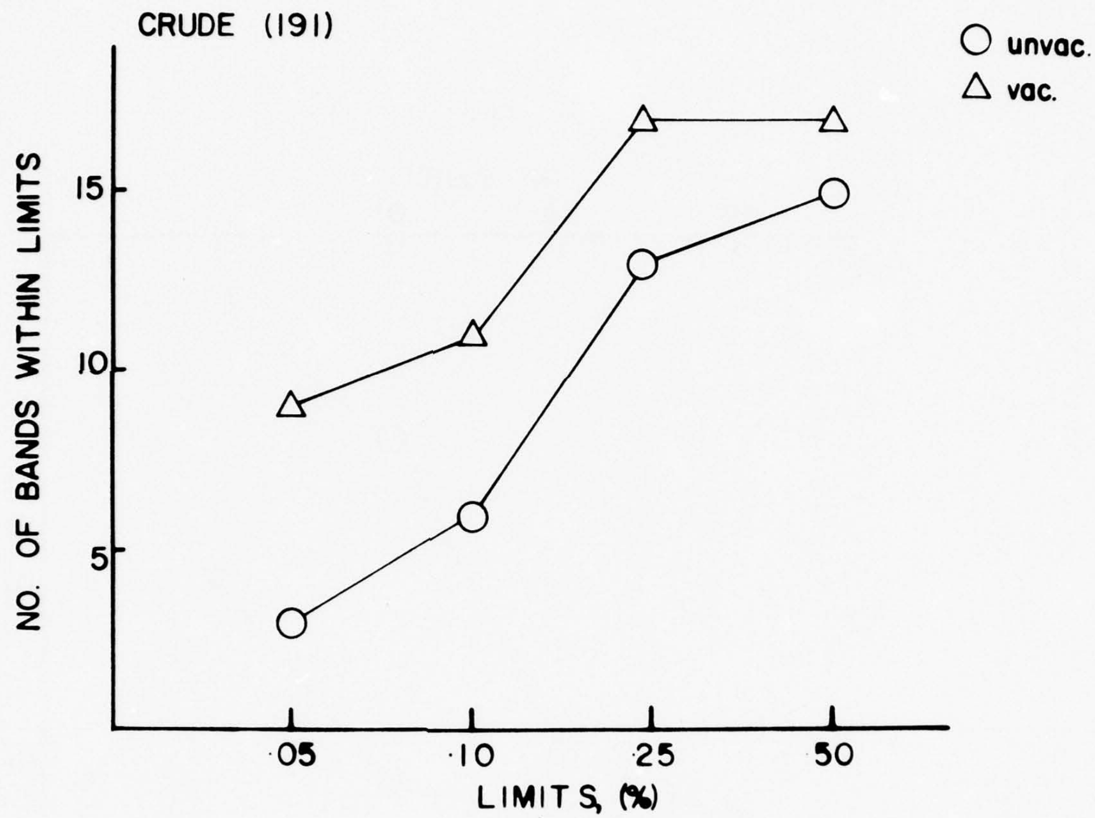


Figure 37. Crude 191

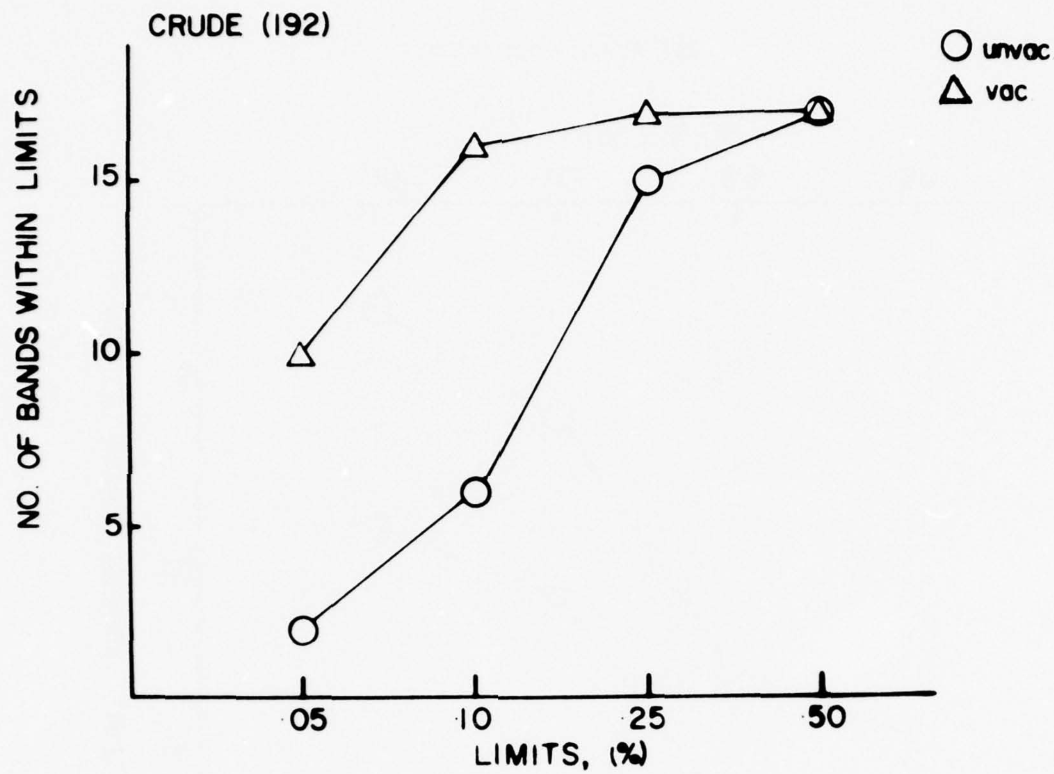


Figure 38. Crude 192

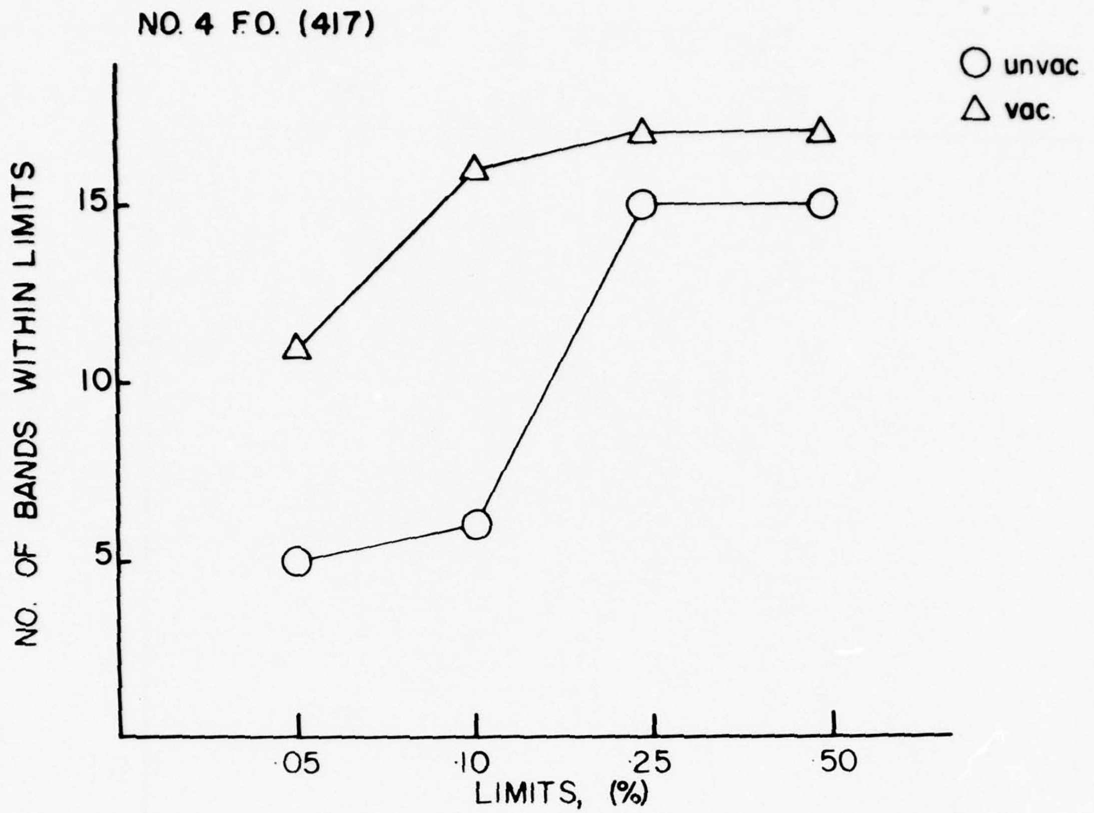


Figure 39. No. 4 fuel 417

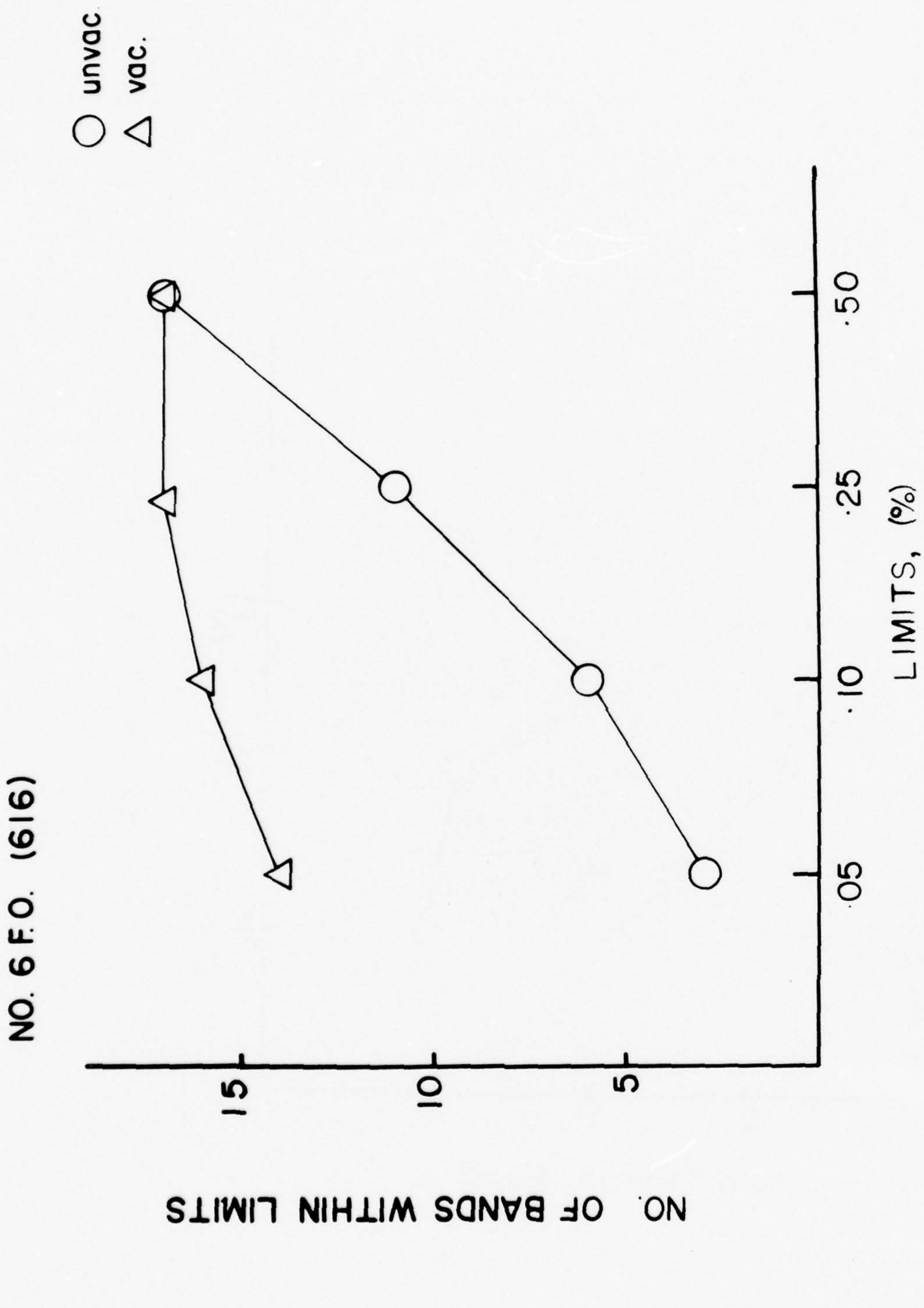


Figure 40. No. 6 fuel 616

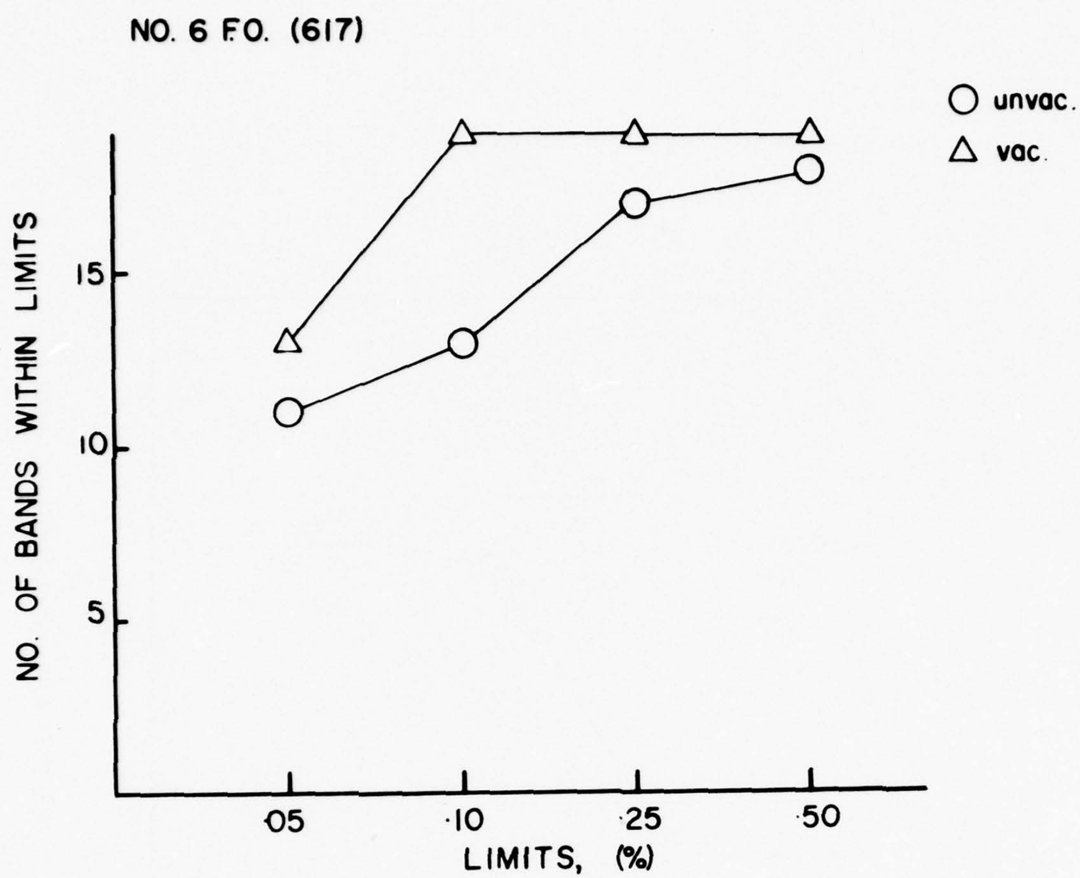


Figure 41. No. 6 fuel 617

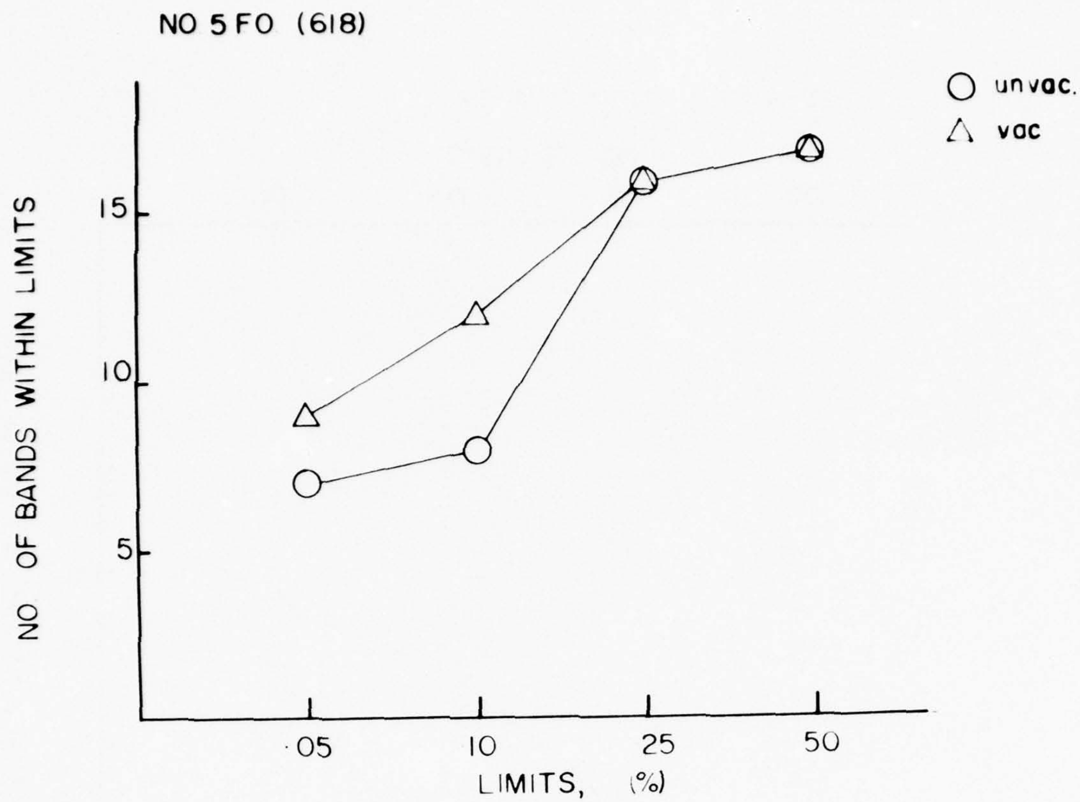


Figure 42. No. 5 fuel 618

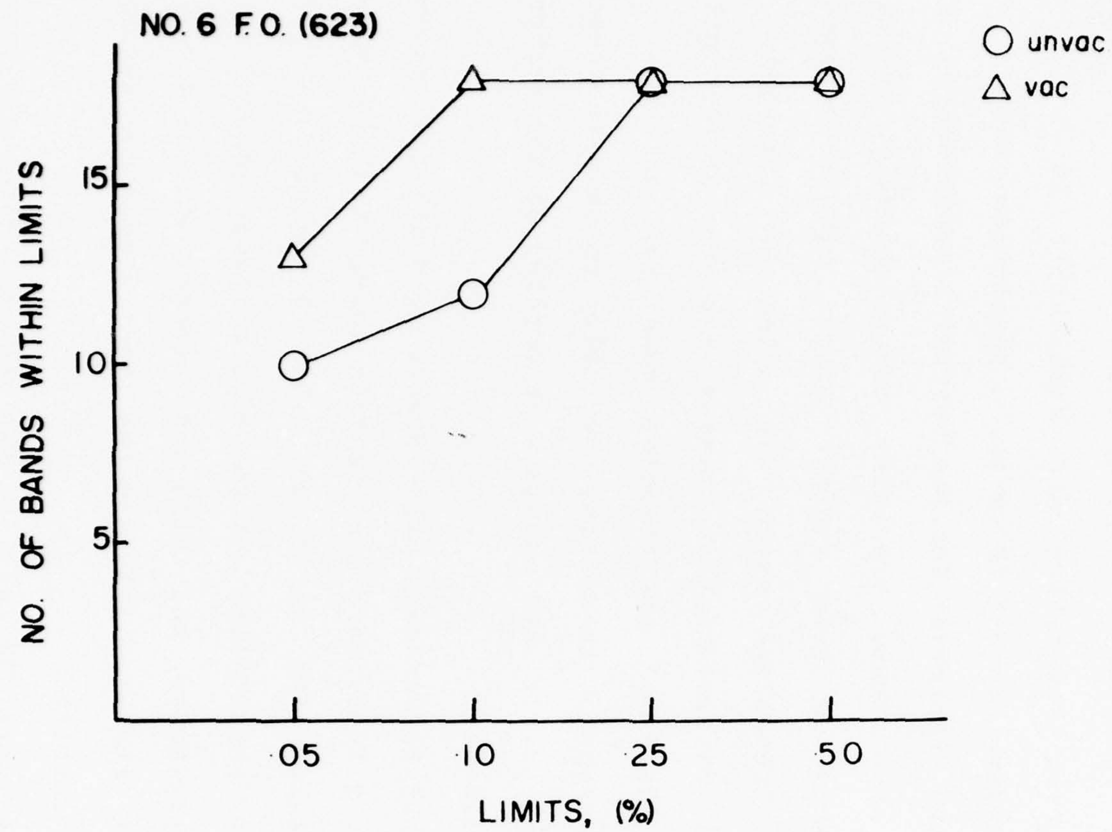


Figure 43. No. 6 fuel 623

IV-D. Effects of Instrumentation and Cell Types

IV-D-1. Instrumentation

IV-D-1-a. Instrument Resolution and Sensitivity

During the course of this investigation infrared spectra were measured on various commercial spectrometers to determine the instrument sophistication necessary to give adequate spectral resolution and sensitivity in the fingerprint region (650-1250 cm^{-1}). Resolution and sensitivity are important for the correct identification of petroleum because there are many sharp, closely spaced absorption bands in this region. There are also some characteristic shoulders which can often be the only distinguishing characteristic between two very similar oil samples. An infrared spectrometer used for oil identification must, therefore, be able to resolve these closely spaced bands and measure absorption of the weaker bands and shoulders.

Three A.P.I. standard oils (Bunker C, South Louisianna crude and No. 2 fuel) were used in this test. The oils were placed in sealed KBr cells of 0.05 mm pathlength. To eliminate the possibility of the oils changing composition during the experiments, the cells were cleaned several times, reloaded with the same oil, and new spectra measured on our P.E. 521 spectrometer.

We have compiled all of the spectral data, and have used our ratio method to compare the spectra measured on each instrument with spectra of the same samples measured on the

P.E. 521. The number of ratios within 10% of the average ratio are listed in Table X.

There is a possible flaw with this test, since all of the instruments are compared to our P.E. 521. Obviously, spectra measured on the P.E. 521 could be inaccurate, which would make the results meaningless. However, all of the "better" instruments had at least 15/18 ratios within 10% of the average. In all cases except one, the comparison of an individual instrument with the P.E. 521 was consistent for all three oils, i.e, the comparisons were either all good or all bad. The one exception is the Beckman Acculab 5, which compared well for two oils and bad for one oil. After studying all of the ratios and spectra very closely we found that this instrument proobably had a bad source, since the background for all of the spectra measured on this instrument were different from those of spectra measured on other insturments. The effect was rather small and it influenced only the results obtained on the No. 2 fuel. Although only 12 ratios were within 10% of the average, all of the other ratios were very close to the 10% cut off.

Table X. Comparison of different instruments. Spectra of three API standard oils measured on 12 instruments are compared with spectra measured on P.E. Model 521 at URI. Eighteen bands were used for all of the comparisons.

No. of Ratios Within 10% of Average

So. La. Crude	No. 2 F.O.	Bunker C	Instrument
11	11	13	P.E. 700 (URI)
13	11	13	735B
17	15	16	180
*	18	*	137
16	15	17	467
17	18	17	567
16	15	17	457 (URI)
15	13	13	Beckman I.R. 8 (URI)
16	12	16	Beckman Acculab 5
17	17	15	Beckman Acculab 6
18	18	16	4240 (slow scan)
18	18	15	4240 (fast scan)

*Spectra on absorbance paper

IV-D-1-b. Comparison of Resolution

Infrared spectra of twelve unweathered and weathered oils (5 crudes and 7 fuels) were measured on a Beckman Model 4240 Digitized Infrared Spectrophotometer. The % transmissions from 1950 to 650 cm^{-1} at 1 cm^{-1} increments were punched onto paper tape along with a six digit identification number for each oil. These data were then entered into our IBM 370/155 time share system through a PDP-9 computer. The % transmissions were converted into absorbtivities and stored in data files for subsequent processing.

The average log ratio technique described in Sec IV-A was used to compare the spectra. Instead of calculating the baseline using two points (1950 and 650 cm^{-1}) a horizontal baseline was assumed using the % transmission at 650 cm^{-1} (some of the oils were only digitized from 1250 to 650 cm^{-1} and therefore lacked % transmission values at 1950 cm^{-1}). Furthermore, we now used 492 transmission values between 1182 and 650 cm^{-1} for each oil, whereas all of the other calculations were limited to 18 selected frequencies.

Comparisions were made using every cm^{-1}, every 10 cm^{-1}, every 20 cm^{-1}, and every 30 cm^{-1}. In the latter three cases, after the initial comparision, the starting wavenumber would be decremented by one wavenumber and another comparison performed, e.g., in the 10 cm^{-1} case, the initial ratio was determined at 1182 cm^{-1} and then at every 10 cm^{-1} down to 692 cm^{-1} (1182, 1172, 1162,...692). The computer would then go back, start at 1181 cm^{-1} and determine the ratio at every ten

wavenumbers down to 701 cm^{-1} (1181, 1171, 1161,...701). This would be repeated ten times. The same procedure was used for the 20th and 30th cm^{-1} comparisons. This method generated more representative data than if an arbitrary starting frequency had been chosen.

The entire computer output for the twelve oils consisted of over 1000 pages. For this report the data for only one oil are listed and discussed. The comparison was made using the weathered crude oil, 154301 as the unknown and comparing it to weathered and unweathered known oils. The percentage of frequencies with absorbtivity ratios within 5, 10, and 25% of the average ratio (using the log ratio method) for the 18 frequencies normally used, and the % range of frequencies for every cm^{-1}, every 10 cm^{-1}, every 20 cm^{-1}, and every 30 cm^{-1} between 1182 and 692 cm^{-1} are listed in Table XI.

Ideally, the best match would be indicated by a high percentage for one oil and a low percentage for the other oils. All the comparisons showed a definite match between the weathered crude, 154301 and the corresponding unweathered crude, 154000. The comparison using 18 selected points yielded the most positive identification, but even the comparisons using every 30 wavenumber resulted in the correct match. Thus, even at a resolution of only thirty wavenumbers it was possible to match a weathered oil to its unweathered source.

For the comparisons ratioing absortivities at every 10,

Table XI. Percentage of Frequencies within Limits using the Ratio Method Comparison of 154301 with:

	Limits - 0.025 (5%)	0.040 (10%)	0.100 (25%)
18 bands			
109000	11	11	39
150000	44	55	83
154000	72	89	100
156000	11	28	67
406000	0	5	33
412000	28	28	67
412342	44	67	89
611000	5	5	5
626000	33	50	94
626461	28	50	94
626462	22	50	89
all cm^{-1}			
109000	21	29	66
150000	51	70	94
154000	75	91	100
156000	24	38	86
406000	10	18	47
412000	35	46	81
412342	57	75	98
611000	4	6	25
626000	41	56	91
626461	25	42	89
626462	30	42	97
every 10th cm^{-1}			
109000	14-26	22-36	61-75
150000	46-57	69-74	92-96
154000	70-79	90-94	100
156000	18-30	33-40	83-90
406000	6-14	14-22	45-49
412000	32-38	40-51	76-86
412342	51-63	69-86	96-100
611000	2-6	4-10	18-29
626000	37-49	47-61	88-94
626461	18-30	36-49	88-92
626462	22-32	36-49	96-98

Table XI. - Continued

Limits -	0.025 (5%)	0.040 (10%)	0.100 (25%)
every 20th cm^{-1}			
109000	12-28	20-37	58-76
150000	40-62	62-76	88-96
154000	68-84	87-96	100
156000	12-32	32-48	79-96
406000	0-17	12-25	33-54
412000	20-40	40-52	75-88
412342	29-72	58-88	92-100
611000	0-8	4-12	12-32
626000	28-50	44-70	84-96
626461	12-37	28-67	80-96
626462	12-46	32-52	96-100
every 30th cm^{-1}			
109000	12-37	11-49	56-76
150000	29-58	62-82	87-100
154000	50-88	75-100	100
156000	12-47	17-64	71-88
406000	6-19	6-31	31-56
412000	23-47	37-56	71-88
412342	37-75	47-87	88-100
611000	0-17	0-12	13-35
626000	29-50	41-75	76-100
626461	6-37	17-56	75-100
626462	11-44	23-50	82-100

20, and 30 cm^{-1} it was necessary to record almost 500 data points compared to the 18 data points required by using 18 selected frequencies. Also in the case of every 30 cm^{-1} it was necessary to run the program 30 times and each time decrement the starting frequency by one wavenumber (similiarly 20 times for every 20 and 10 times for every 10 cm^{-1}). Because of the large volume of data involved in digitizing every wavenumber it was impossible to run an efficient computer time share program, since each oil required that a separate data file be opened and closed each time it was compared to the unknown. Obviously, this greatly increased computer time and computer costs. Therefore, we recommend in the case of digitized infrared spectra that only data at specific selected frequencies be entered into the permanent computer data files. This may easily be accomplished by storing the entire digitized infrared output in a temporary computer data file, selecting the % transmission values at the desired frequencies, and then storing those selected values in the permanent computer file to be used in subsequent identification programs. In this way unnecessary data and thus unnecessary computer time and costs are avoided.

Prior to the investigation just discussed a preliminary study had been conducted involving only four oils and using the % transmission value at 1950 cm^{-1} to draw a horizontal baseline. However, the actual baseline for one of the oils exhibited a positive slope toward the lower wavenumbers and

starting at 700 cm^{-1} the % transmission values began to fall above the horizontally drawn 1950 cm^{-1} baseline. This resulted in negative absorptivities in the 700-650 cm^{-1} region. In situations where the baseline is not perfectly horizontal and assuming that the baseline should be drawn in the 650-1950 cm^{-1} region there are two feasible solutions. The infrared transmission data at 1950 cm^{-1} and 650 cm^{-1} can be examined to select the highest % transmission and the baseline can be drawn from the highest point. However, when there are a large number of spectra involved, 1/3 may have 1950 cm^{-1} as the highest, 1/3 may have 650 cm^{-1} as the highest, and 1/3 may have an ideal horizontal baseline which would thus result in a random assignment of baselines. The second solution would be to draw the baseline from the % transmission value at 1950 cm^{-1} to the % transmission value at 650 cm^{-1} thus eliminating any decision process. Most of the oils examined have had very small % transmission differences between 1950 cm^{-1} and 650 cm^{-1}. This resulted in negligible differences in the final average by the log ratio analysis when the baselines were drawn from only one point and when drawn using two points. For reasons of efficiency (one less decision process) and for consistency we recommend the baseline be drawn from 1950 cm^{-1} to 650 cm^{-1}.

IV-D-2. Dependence of Cell Type on Spectral Measurements

To determine the effect of cell type on the spectral fingerprints, spectra of the three A.P.I. standard oils were measured with the oils contained in AgCl, KBr and NaCl cells (0.05 mm pathlength in all cases). A demountable AgCl cell and sealed KBr and NaCl cells were used for this study. All spectra were measured on a P.E. 521 spectrometer.

Spectra for each of the oils measured in the three different cells were compared by the ratio method, and the ratios within 10% of the average were used as a measure of similarity. The results for the crude oil are given in Table XII. Spectra measured in the AgCl and KBr cells gave a perfect match (18/18), whereas neither cell compared well with the NaCl cell. The results for the No. 2 fuel are given in Table XIII. In this case the comparison is good between KBr and AgCl and again, neither cell compared well with NaCl. The results for the Bunker C oil are given in Table XIV. The spectrum of the oil in the KBr cell was measured on two different occasions to determine the reproducibility of the spectral measurements. Both spectra measured in the KBr cell compared favorably with each other and with the spectrum measured in the AgCl cell. However, comparison of the spectra measured in the AgCl and KBr cells with that measured in a NaCl cell was only fair.

For all three oils the spectra measured in the AgCl and KBr cells compared favorably.

Table XII. Comparison of Spectra of So. La. Crude Oil (API) Measured with AgCl, KBr, and NaCl Windows.*

No. of Ratios within 10% of Average

	AgCl	KBr	NaCl
AgCl	18	18	14
KBr	18	18	15
NaCl	14	15	18

Table XIII. Comparison of Spectra of No. 2 Fuel Oil Measured with AgCl, KBr, and NaCl Windows.*

No. of Ratios within 10% of Average

	AgCl	KBr	NaCl
AgCl	18	17	11
KBr	17	18	15
NaCl	11	15	18

Table XIV. Comparison of Spectra of Bunker-C Fuel Oil Measured with AgCl, KBr, and NaCl Windows.*

No. of Ratios within 10% of Average

	AgCl	KBr	KBr	NaCl
AgCl	18	16	18	10
KBr	16	18	18	11
KBr	18	18	18	11
NaCl	10	11	11	18

*A demountable AgCl cell, and sealed KBr and NaCl cells were used; all had pathlengths of 0.05 mm. Eighteen bands were used for all of the comparisons.

IV-E. New and Modified Methods for Computer Analysis of Spectral Data

In addition to testing the original ratio method with the modifications given in Sec. IV-A, we have added probability of identification (or confidence limit) to the analysis, and we have explored another different approach of analyzing the spectral data.

IV-E-1. Probabilities Using the Ratio Method (23).

IV-E-1-a. The Probability Function.

To determine the closeness of a "match" using the ratio method, we defined a statistic which would be similar to a normal statistic, and then transformed this "defined" statistic so that it had approximately an F distribution We define this statistic as the "sum of squares," i.e.,

$$S^2 = \sum_i \left(\log \frac{A_i}{A_i''} - \frac{1}{18} \sum_i \log \frac{A_i}{A_i''}\right)^2 \qquad (1)$$

This is not the usual sum of squares which is defined as

$$\sum_i (X_i - \overline{X}_i)^2 \qquad (2)$$

but there is a similarity.

Since our statistic contains a ratio of observables, we found that we could transform it so that the distribution of S^2 (i.e., (S^2)) matches an F-distribution. The F statistic is reasonable to use, since it is defined as a ratio (26)

$$F = \frac{Y_1/\nu_1}{Y_2/\nu_2} \tag{3}$$

where Y are independent random variables, and are the degrees of freedom for each. If the number of degrees of freedom are the same for both samples, the F-probability density is given by

$$(F) = \frac{\Gamma(\nu)}{(\Gamma(\nu/2))^2} F^{(\nu-2)/2} (1 + F)^{-\nu} \tag{4}$$

To transform the density function for S^2 into the density function for F we multiply all S^2 values by a constant, t, i.e.,

$$S^2 = t\ S^2 \tag{5}$$

so that the maximum value of (S^2) is the same as that for

(F).

The frequencies of occurrence for $S^{2\prime}$ are compared to those for F with 3, 11 and 17 degrees of freedom in Figure 44. By using a sliding ordinate scale we have made the maxima for $\phi(S^2)$ and all three $\phi(F)$ distributions occur at the same value. It is obvious from this diagram that the number of degrees of freedom for $S^{2\prime}$ is somewhere between 3 and 11. Next we fitted $\phi(S^{2\prime})$ to the F density functions with 3, 4, 5 ..... 11 degrees of freedom and found that 5 degrees gives the best fit. The F density function with 5 degrees is compared to the $(S^{2\prime})$ distribution for 18,981 unweathered pairs (all oils are from different sources) in Figure 45. The value of the transformation constant, t, is 3.49. The transformed S^2 distribution for 345,030 pairs of weathered and unweathered oils (only data for different oils were included) is shown in Figure 46. Again, the fit is good; however, the value of t is 3.91 in this case. The value is slightly higher, since weathering has a tendency to make all oils similar and to decrease the value of S^2 at which the maximum density appears.

IV-E-1-b. Degrees of Freedom

We might first anticipate having 17 degrees of freedom considering that we are using 18 bands for identification; however, as pointed out by Mattson, et al. (27), many of the bands are highly correlated. This is the obvious explanation

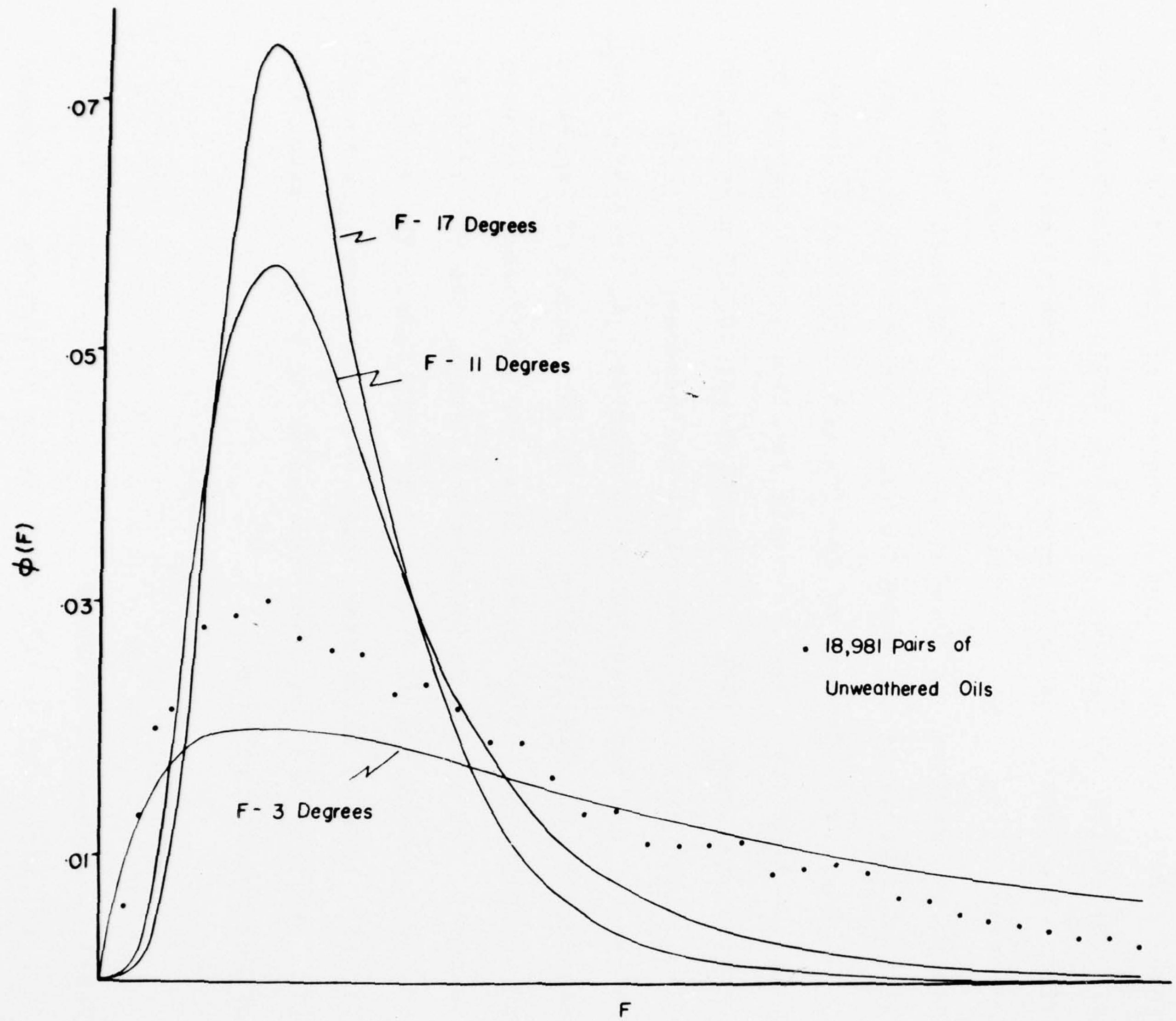


Figure 44. Frequency of occurrence of $S^{2'}$ compared to probability density curves for an F-distribution with 3, 11 and 17 degrees of freedom

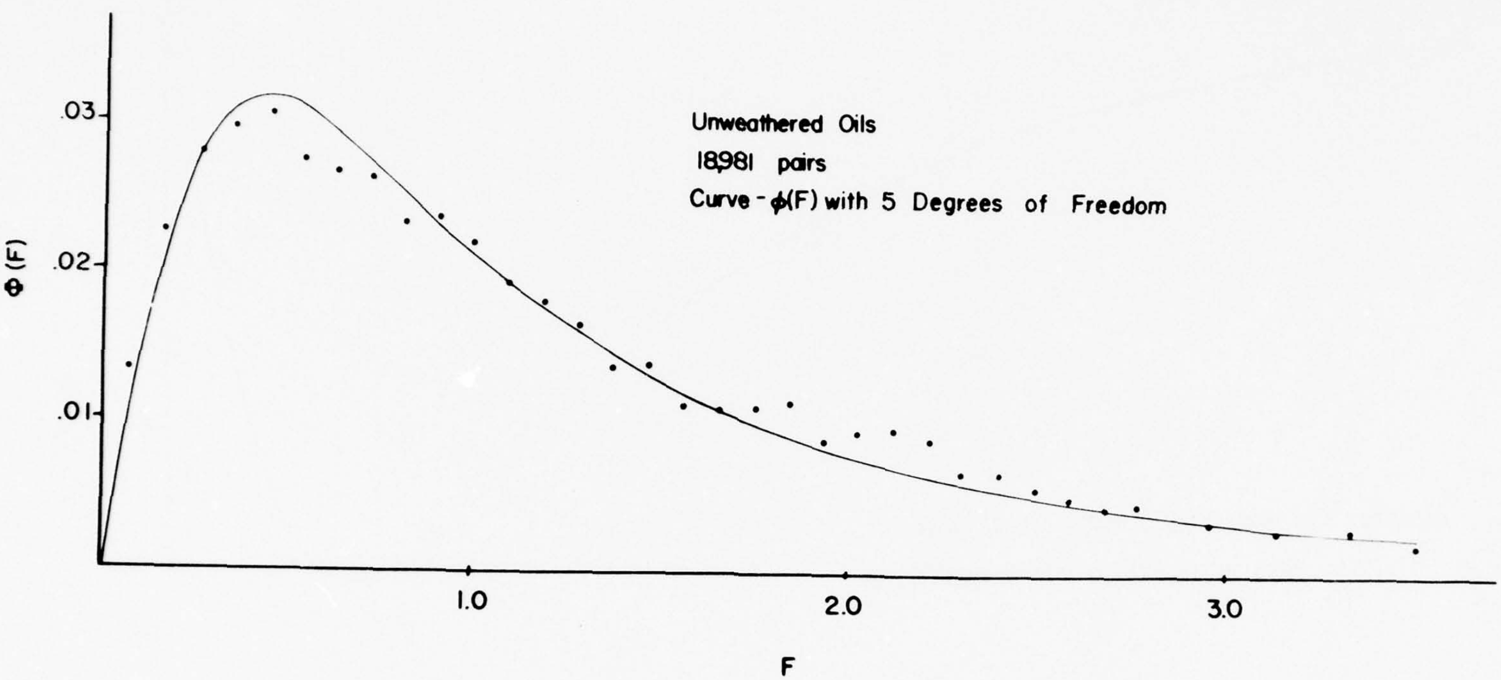


Figure 45. Frequency of occurrence of $S^{2'}$ for 18,981 unweathered pairs of oils compared to F-distribution with 5 degrees of freedom

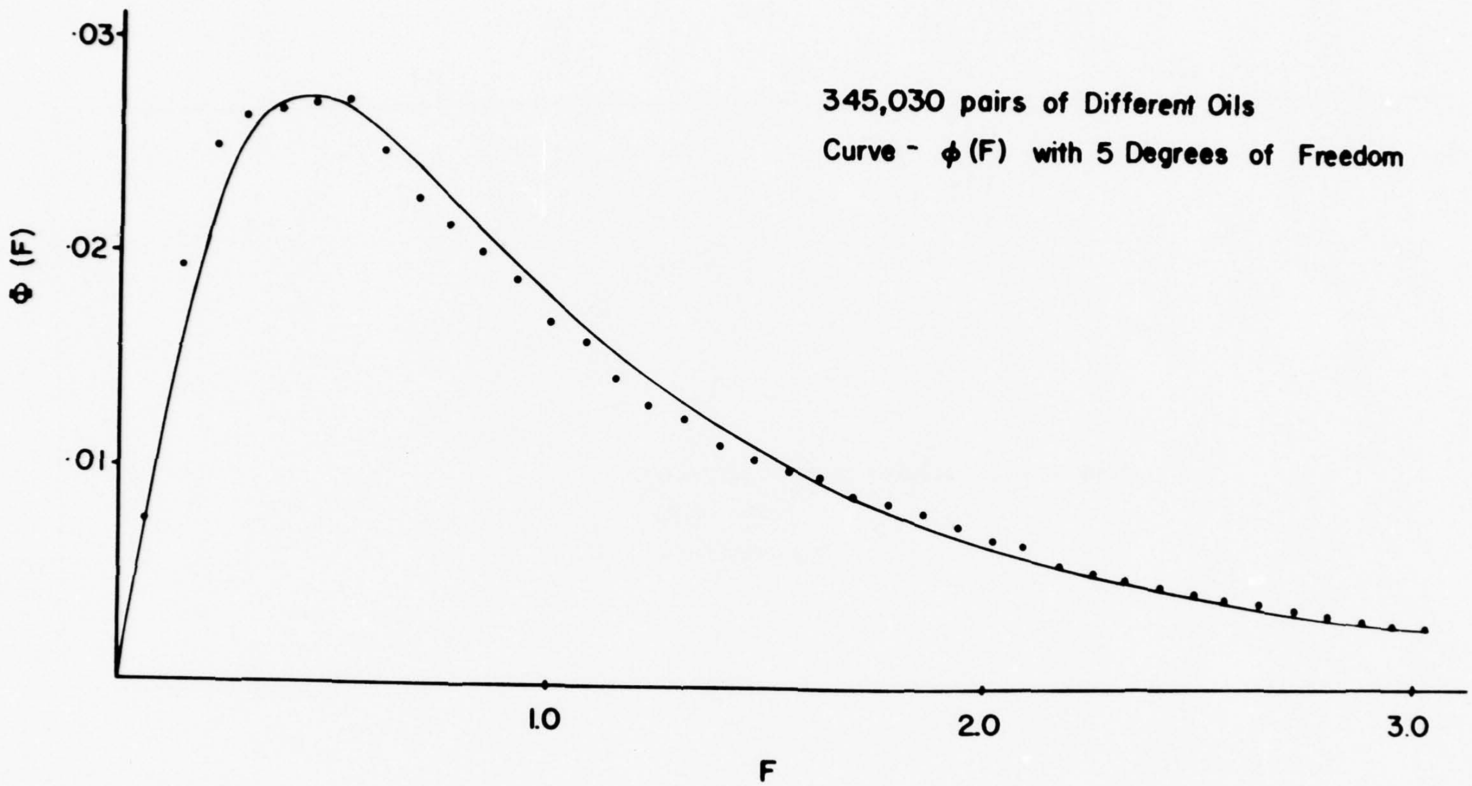


Figure 46. Frequency of occurrence of $S^{2'}$ for 345,030 pairs of different weathered and unweathered oils compared to F-distribution with 5 degrees of freedom

for having only 5 degrees of freedom rather than 17. Since we have some bands that are different than those used by Mattson, et al., and since we are including weathered in addition to unweathered oils, we have recalculated the correlation coefficients given by the equation

$$r = \frac{\Sigma X_i Y_i - \frac{1}{n} \Sigma X_i \Sigma Y_i}{[(\Sigma X_i^2 - \frac{1}{n} (\Sigma X_i)^2)(\Sigma Y_i^2 - \frac{1}{n}(\Sigma Y_i)^2)]^{1/2}} \tag{6}$$

where X_i and Y_i are the absorbances of two different bands, and the summation is over all spectra. In order to eliminate the pathlength dependence, we normalize all bands to the one at 915 cm^{-1}; this band was chosen for the normalization, since it appears to change less with weathering.

The correlation coefficients between all pairs of bands for a total of 290 unweathered oils and 579 weathered oils are given in Table XV. A general trend in the data is that most of the bands below 900 cm^{-1} correlate highly with each other, and all of the bands above 900 cm^{-1} correlate highly with each other. The reason for this is that the background above 900 cm^{-1} increases with weathering (20). Since we are including data for weathered oils we find two sets of bands with high correlations within each set.

On the basis of the results given in Table XV we repeated the calculation of the probability density function $\phi(S^{2\prime})$ after eliminating the nine bands at 695, 765, 780,

TABLE XV. Correlation Coefficients Between Pairs of Bands (for 869 Weathered and Unweathered Oils)

	695	720	725	740	765	780	790	810	835	845	870	890	955	1030	1070	1145	1160
695	-	.97	.15	.97	.95	.95	.94	.95	.73	.70	.71	.88	.04	.01	.00	-.02	-.02
720		-	.21	.98	.94	.94	.93	.94	.71	.70	.72	.90	.01	.00	.00	-.02	-.02
725			-	.17	.22	.17	.16	.12	.12	.18	.19	.19	-.25	-.22	-.23	-.20	-.22
740				-	.97	.97	.97	.98	.81	.79	.81	.94	.03	.05	.02	.01	.01
765					-	.98	.98	.98	.86	.85	.87	.95	.02	.06	.01	.01	.01
780						-	.99	.99	.87	.86	.86	.95	.03	.05	.01	.00	.00
790							-	.99	.88	.88	.87	.95	.05	.09	.04	.03	.03
810								-	.89	.87	.88	.96	.05	.10	.05	.04	.04
835									-	.97	.97	.92	.08	.19	.09	.09	.08
845										-	.97	.91	.05	.17	.07	.08	.06
870											-	.93	.03	.18	.06	.07	.07
890												-	.05	.12	.07	.06	.04
955													-	.90	.92	.89	.89
1030														-	.95	.94	.95
1070															-	.97	.96
1145																-	.99
1160																	-

790, 835, 845, 890, 1070, 1145 cm^{-1}. The band at 695 cm^{-1} was eliminated both on the basis of high correlation and on the fact that it changes drastically with weathering. The distribution obtained after transforming S^2 to $S^{2'}$ is compared to the F-distribution with 5 degrees of freedom in Figure 47. The fit is not quite as good as that obtained using all of the bands, but it is still acceptable . By trying to eliminate additional bands an acceptable fit could not be obtained.

This part of the study shows that some bands can be eliminated from the analysis without reducing the number of degrees of freedom. However, in some actual spill cases, we have found one or more of these bands pertinent to making a correct identification. Thus, for the present, we are retaining all 18 bands for an analysis.

IV-E-1-c. Probability of Identification

The observed density, (S^2), for 345,030 pairs of different oils and for 5,534 pairs of the same oils (weathered/unweathered and weathered/weathered, i.e., two oils weathered for different time periods or at different locations) are plotted in Figure 48. The comparison shows that the S^2 values for pairs of the same oils are close to zero; however, there is some overlap with the curve for different oils, i.e., some pairs of different oils have S^2 values less than those for the same oils. The closeness of a correct match is based on the fraction of different pairs,

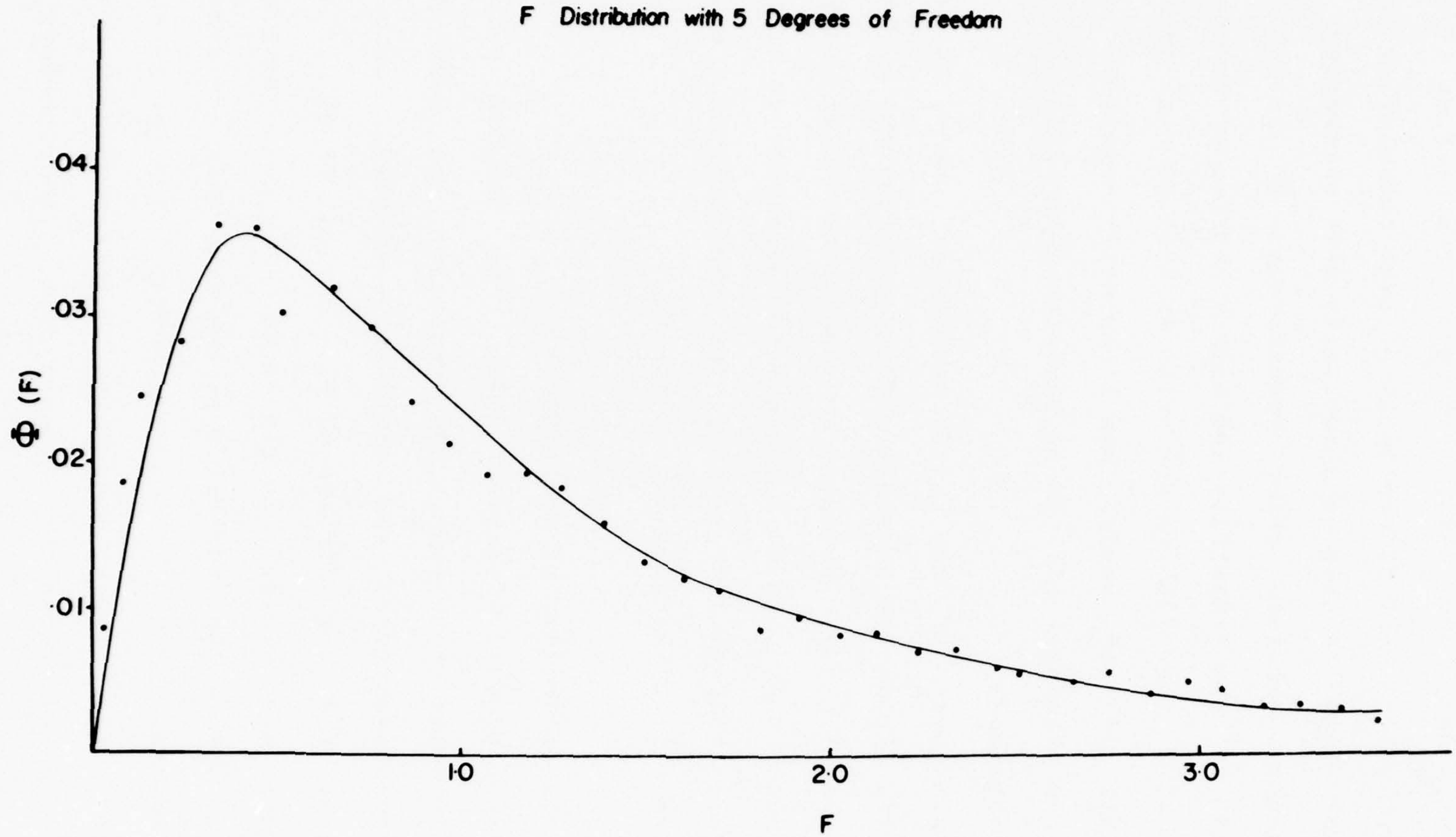


Figure 47. Frequency of occurrence of $S^{2'}$ for 18,891 unweathered pairs of oils using only 9 bands compared to F-distribution with 5 degrees of freedom

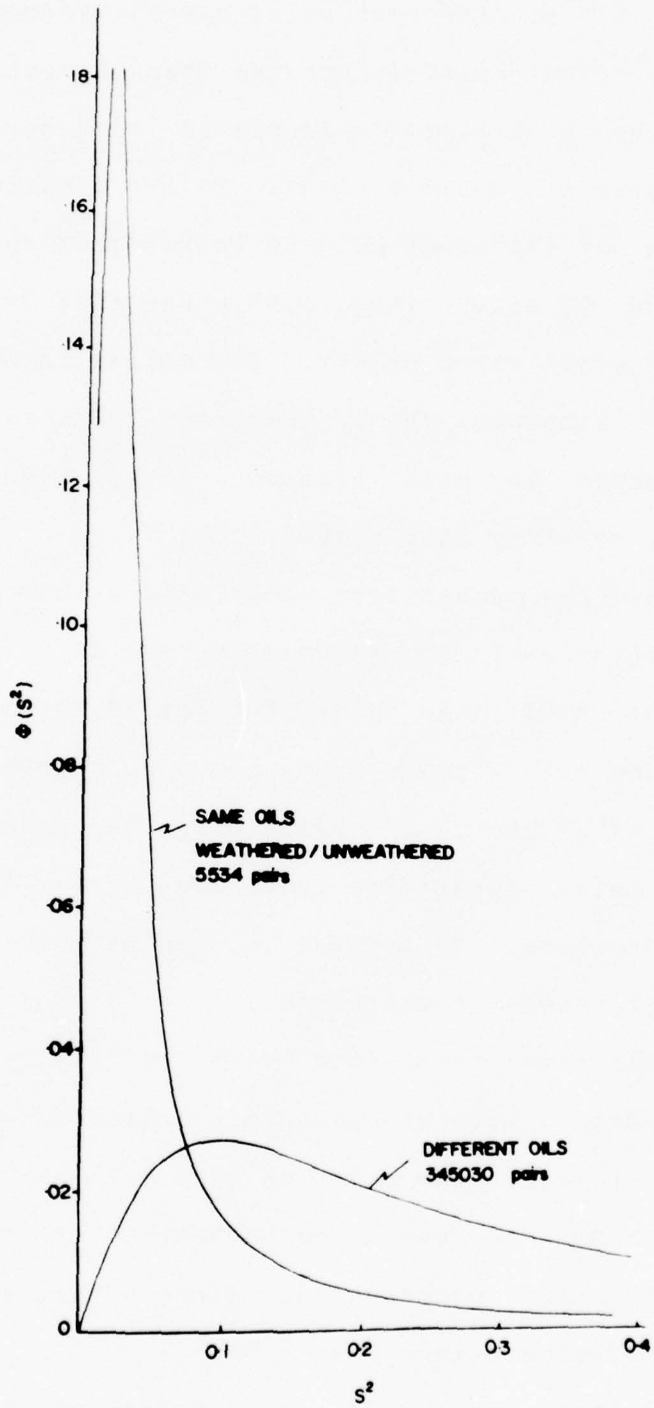


Figure 48. The observed density functions for 345,030 pairs of different oils and 5,534 pairs of the same oils

having S^2 values larger than the pair under consideration. For example, if 93% of different pairs have S^2 values (or F values after the transformation) greater than the pair under consideration, the probability associated with the latter pair being the same oil would be 0.93. We are assuming here that our sample of different oils is representative of the entire population of oils. Thus, 0.93 means that 7% of all oils in the world would match better. For spills involving a known number of suspects the probability of obtaining a correct match would be much higher. Thus, the lowest possible value is given by this method.

To calculate the probability associated with a pair of spectra being identical, we first calculate S^2 by eqn. 1, multiply this by 3.49 (the value of t for 18,981 pairs of different oils) to get $S^{2\prime}$, and integrate eqn. 4 between the limits of 0 and $S^{2\prime}$. The latter value gives the fraction of oils from the total population that match better than the pair under consideration. This value is then subtracted from 1.0 to give the closeness of the match.

The probabilities associated with matching the same oils from the spectral data stored in our computer data bank are given in Table XVI. The pairs in this data set include weathered/unweathered and weathered/weathered of the same oil. The results are encouraging, since 67% of all like pairs match with a value better than 0.95.

The probabilities associated with matching spectra of a weathered oil with the same unweathered source oil are given

TABLE XVI. Probabilities Associated with Matching Same Oils. Comparisons are made for weathered/unweathered and for weathered/weathered spectra of the same oil

Probability	Number of Pairs	Percentage of total
0.999	656	12
0.99	2403	43
0.95	3744	67
0.90	4213	76
total number	5569	

in Table XVII; values are given for oils weathered 2, 7, and 14 days. Even after only two days of weathering only 42% of the oils match with a probability >0.95, and this decreases with weathering time.

The results in Table XVII are not as good as those in Table XVI, since results are included in the latter table for weathered oil vs the same oil weathered for a different length of time. In other words, comparison of weathered with weathered oils has a much higher probability of matching. This implies that it is possible to match an oil from an actual spill to the correct suspect, if all of the suspect oils are weathered.

It takes several days and considerable effort to "weather" an oil under natural conditions; however, using the vacuum method described in sec III-C-2 we can simulate the first few days of natural weathering in approximately 2 hrs. We have tested the probability relationship on a limited number of oils treated in this manner, and the results are given in Table XVIII. These results are very satisfying, since they show that 97% of oils weathered 2 days and 90% of oils weathered 7 days can be matched with a probability >0.95. This method of simulating weathering is not good for long periods as is indicated by the 14 day results; at these longer weathering periods oxidation plays an important role in the weathering process.

TABLE XVII. Probabilities Associated with Matching Spectra of Weathered Oil with the Same Unweathered Oil

Probability	Time of Weathering							
	2 Days		7 Days		14 Days		Total	
	Number	%	Number	%	Number	%	Number	%
0.999	20	6	11	4	9	4	40	5
0.99	65	19	39	16	27	12	131	16
0.95	140	42	83	34	52	24	275	34
0.90	180	54	105	43	67	31	352	44
Total	334	100	245	100	219	100	798	100

TABLE XVIII. Probabilities Associated with Matching Spectra of Weathered Oil with the Same Unweathered Oil After All Unweathered Samples were Vacuum-Treated

Probability	Time of Weathering					
	2 Days		7 Days		14 Days	
	Number	%	Number	%	Number	%
0.999	11	29	8	19	5	12
0.99	31	82	25	60	17	40
0.95	37	97	38	90	23	55
0.90	38	100	40	95	24	57
Total	38		42	100	42	100

IV-E-2. Pattern Recognition Using Correlation Coefficients.

This method is based on the assumption that an unknown weathered oil will correlate better with other weathered samples of the same oil than it will with weathered samples of other oils. By using laboratory weathered oils we show that the "known" data base can be made up of artificially weathered oils.

Six weathered samples (three weathered in the lab and three weathered on the Bay, at the aquarium, or on the roof of the lab) of twenty-one different oils were used to test the method; the identification numbers of the oils used in this test case are given in Table XIX. Of the six samples of each oil, one was arbitrarily chosen as an unknown and the remaining five added to a "known" data file, i.e., spectral data for 105 oils were stored in the known data file.

Spectral data for each of the 21 unknown samples were compared to those data for all of the 105 known samples. In this case, we did not use the ratio method, rather we calculated the correlation coefficient between each unknown and each of the knowns stored in the file by the equation 6 where, in this case, X_i are the absorptivities for the known and Y_i the absorptivities for the unknown. For each unknown we sorted all of the knowns (all 105) by decreasing correlation coefficients. In general, the coefficients for the same oils "clustered" toward the top. We then used a "weighted" Kth nearest neighbor technique with K=5 to identify the source of the unknown oil, i.e., the known oil

TABLE XIX. Listing of Oils Used to Test the Method of Identifying Sources by Correlation Coefficients

152101	178101	608101
103	102	102
104	103	103
311	301	301
312	302	302
313	303	303
162101	179101	610101
102	102	103
202	103	201
301	301	301
302	302	302
303	303	303
169101	181101	613101
102	102	102
103	103	103
301	331	301
302	332	302
303	333	303
171101	185101	620441
102	102	442
103	103	443
301	301	301
302	302	302
303	303	303
172101	213411	622451
102	412	452
103	413	453
331	301	411
332	302	412
333	303	413
174101	605101	623301
102	102	302
103	103	303
311	331	452
312	332	453
313	333	454
177101	607101	626121
102	102	122
103	103	123
331	331	351
332	332	352
333	333	353

with the highest correlation coefficient is given a "vote" of 5, the second highest a "vote" of 4, etc. Then we summed the "votes" for the weathered samples of the same oils. The correct source should have the highest total vote.

The results for the 21 oils used in this test are given in Table XX. On comparing the first sample 152312, with all of the 105 knowns, we find that it correlates higher with the five samples of the same oil than it does with any of the other 105 oils; thus, 152 got all 15 votes and it is chosen unanimously. In the second case, 162101, the first and fifth highest correlations are with samples of 179, the second and third highest with samples of 162, and the fourth highest with 169. Thus, 162 received seven votes (4+3), 179 six votes (5+1), and 169 two votes for fourth place. Again, the correct oil, 162, was chosen. Out of the 21 test cases, 16 oils were correctly identified, 4 were tied for first, and one was in second place. If "ties" are counted as correctly identified, this means that the success rate is >95%. It should be pointed out that many of the oils used in these tests were similar; thus, the success rate is very encouraging.

TABLE XX. Weighted K-Nearest Neighbor (K=5) Pattern of Correlation Coefficients Obtained by Comparing Unknown Spectra with all Spectra in the File.

Unknown[a] No.	Known No. (votes)[b]	Selection of Unknown
152312	152(15)	first
162101	162(7), 179(6), 169(2)	first
169101	169(12), 626(3)	first
171102	171(7), 177(7), 178(1)	tie for first
172332	172(7), 178(5), 171(3)	first
174313	174(13), 607(2)	first
177102	177(9), 171(3), 178(2)	first
178301	178(5), 610(5), 172(4), 622(1)	tie for first
179103	179(5), 169(5), 162(3), 626(2)	tie for first
181333	181(14), 152(1)	first
185301	185(12), 620(3)	first
213413	213(11), 181(4)	first
605332	605(15)	first
607103	185(7), 607(6), 620(2)	second
608101	608(12), 607(3)	first
610303	610(14), 178(1)	first
613101	613(9), 178(3), 171(2)	first
620442	620(5), 185(5), 607(4), 174(1)	tie for first
622452	622(11), 610(3), 613(1)	first
623302	623(15)	first
626351	626(9), 169(6)	first

[a]the first three digits in the Unknown No. correspond to the Known No.
[b]only Known No. are given, since the votes for weathered samples of the same known are summed; total votes are given in parentheses.

V. CONCLUSIONS

The spectral advantage of infrared as a technique in oil spill identification occurs because all components of petroleum absorb in the infrared. The significance of this attribute was recognized in the course of measuring and analyzing the spectra of many weathered samples of petroleum (28). To illustrate its importance, consider the following examples.

The spectra of a crude oil and its kerosene, No. 2 fuel, and residuum fractions are shown in Figure 49. Each fraction has its own distinctive fingerprint, and the spectrum of the crude oil is essentially the sum of the three fractions. If the lower boiling components, e.g., the kerosene and No. 2 fuel, are removed from the crude by distillation, the fingerprint of the residuum can be used to identify the crude.

Next, let us consider the changes in the spectra as petroleum weathers. In Figure 50 the spectrum of a crude oil weathered 7 days (b) is compared with the spectrum of the unweathered crude (a). Spectrum (c) is the difference spectrum measured with the weathered oil in the sample beam and the unweathered oil in the reference beam of a double-beam spectrometer. Components that increase during weathering are indicated by bands below the baseline, whereas components that decrease are indicated by bands above the baseline. The strong band at 1700 cm^{-1} indicates an increase in carbonyl compounds during weathering. In the 700 to 900

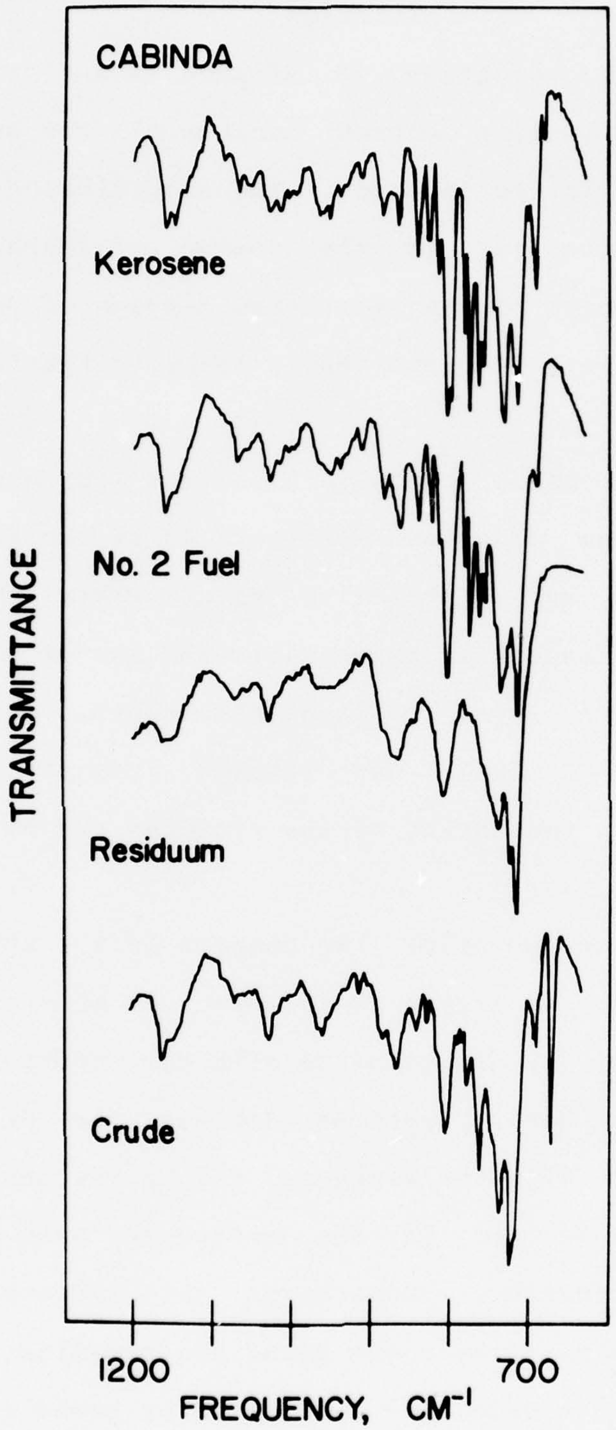


Figure 49. Infrared spectra of a crude oil and its kerosene, No. 2 fuel and residuum fractions.

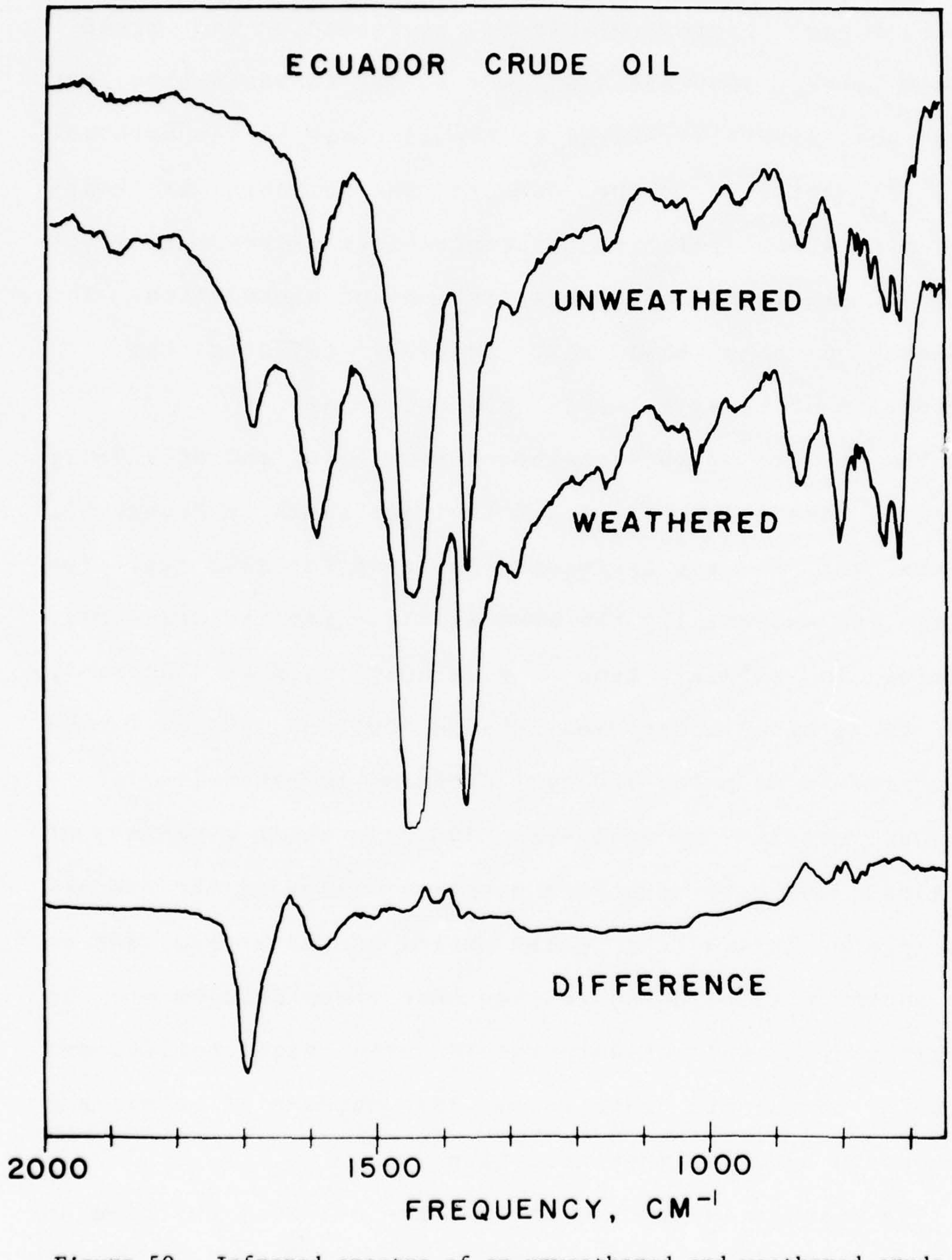


Figure 50. Infrared spectra of an unweathered and weathered crude, and the difference spectrum.

cm^{-1} region we see that components causing the weak, sharp bands are lost during weathering; however, the stronger, broader bands remain relatively unchanged. The broad increase between 1000 and 1400 cm^{-1} is due to weathering, but it is not directly related to the increase in the carbonyl band. It appears to be due to an increase in heavy components whose relative concentrations increase as light components are lost through evaporation and dissolution. The broadness of this band most probably reflects the distribution of heavy molecules present in oil.

The spectra of an unweathered sample (a) and of a 7-day weathered sample (b) of a No. 6 fuel are shown in Figure 51. Spectrum (c) is the difference spectrum for this oil. The results are essentially the same as those for the crude oil. Oxidation is evident from the carbonyl band at 1700 cm^{-1}, there is a broad absorption between 1000 and 1400 cm^{-1}, and some of the bands below 900 cm^{-1} decrease in intensity.

Our results on weathering 100 oils under a variety of conditions indicate that the greatest change in the spectra takes place during the early period of weathering, and we have substantial evidence to show that these changes are due to evaporation and dissolution.[18] The high boiling and insoluble components remain on the surface of water, and these can be used for identification.

The changes in spectra for a crude oil as a function of weathering time are shown in Figure 52, where an unweathered oil is compared to weathered samples taken at 2, 7, and 14

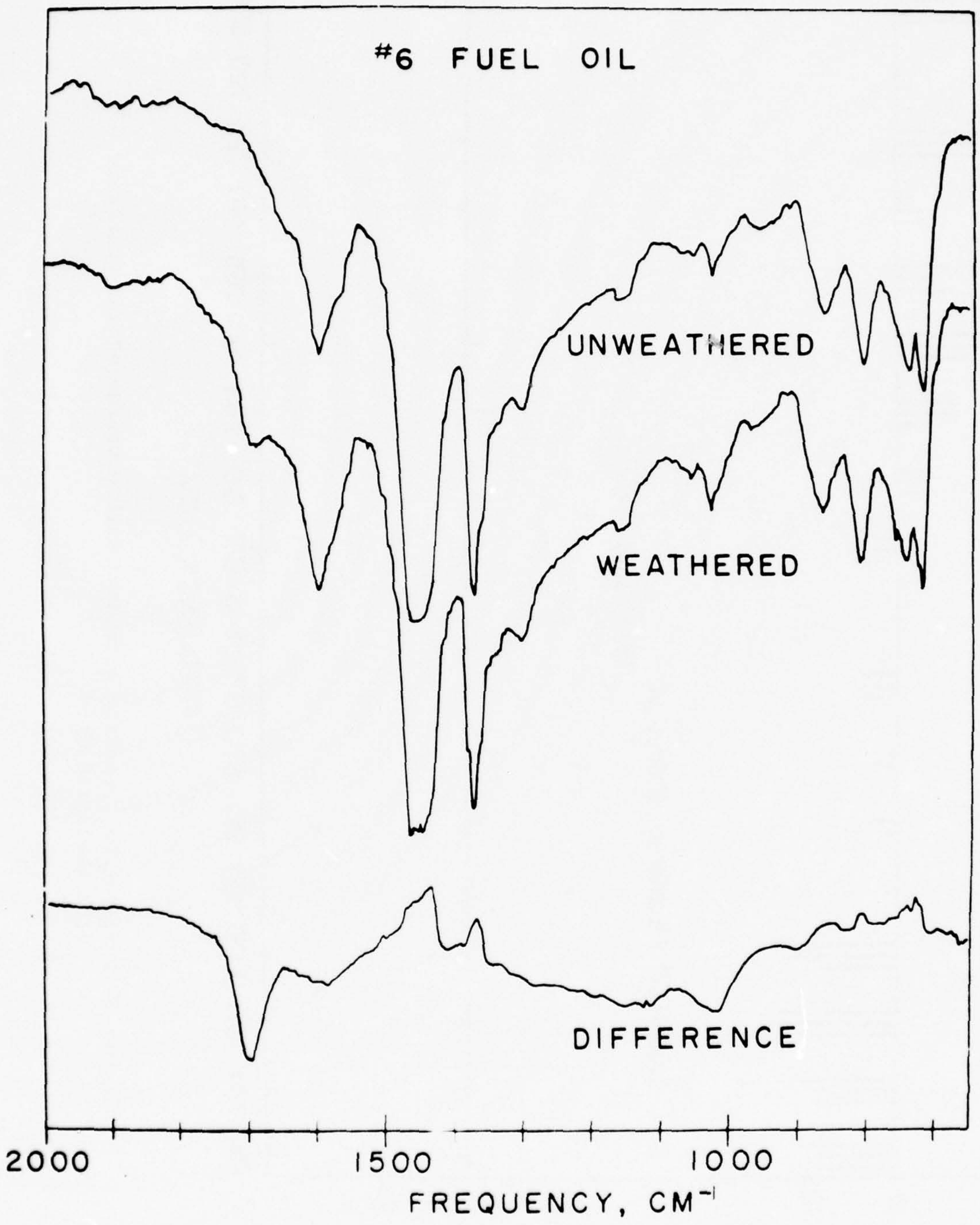


Figure 51. Infrared spectrum of an unweathered and weathered No. 6 fuel oil, and the difference spectrum.

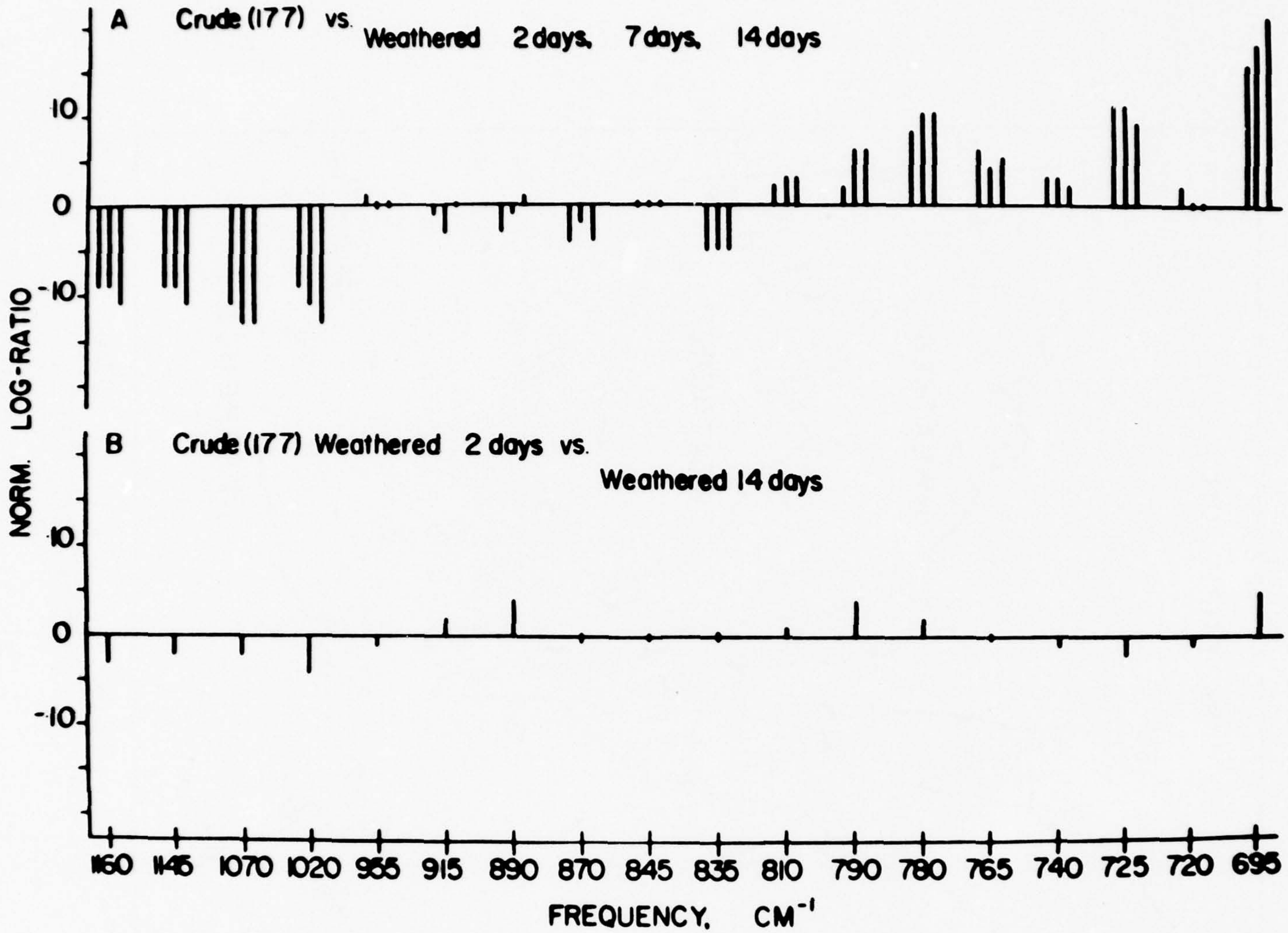


Figure 52. Histogram comparing weathered with unweathered and weathered with weathered oils.

days. It is obvious that the greatest change takes place during the first 2 days. Using the ratio method to compare the 2-day sample to the unweathered sample, we find only 8 of 18 ratios within 10% of the average. However, if we ratio the spectrum of the 7-day sample with that of the 2-day sample, 18 of 18 ratios are within 10% of the average. For the 14-day vs. 2-day sample, 17 of 18 bands are within 10%; the plot obtained by ratioing the 14-day with the 2-day spectra is shown on the bottom of Figure 52. Thus, it may be difficult to match the spectrum of a weathered sample with an unweathered sample since light components are lost during weathering. However, since infrared is sensitive to the heavier components, matching the spectra of two weathered oils works very well.

In the case of a spill where several tankers are suspected, the spilled oil can be compared directly to the unweathered oils from the tankers. However, the tanker samples can be artificially weathered, and when the spill sample is compared with these, the "match" with the correct source will be excellent. This is so because the light components can be removed by artificial weathering in the same manner that they are removed by natural weathering. For spill samples weathered 1 week or less, we found that the vacuum treatment discussed in Sec. IV-C-2 provides excellent simulation of natural weathering.

As the conclusion to this report we demonstrate the use of the vacuum treatment, the ratio method with closeness of

match, and the method of correlation coefficients to identify the source of an actual spill. In this case the data bank consists of 15 crudes, one No. 2 fuel, and eleven No. 5 and 6 fuels. The spectrum of the sample from the actual slick is compared with each of these oils after they have been vacuum-treated. Both the probabilities and the correlation coefficients given in Table XXI indicate that the sample from the slick is the same as 623 and 624. Both of these oils were taken from the tanker responsible for the spill; thus, both methods of computer analysis picked the correct source of the spill.

Finally, it should be emphasized that closeness of match obtained by the ratio method are for one oil matching all oils in the world, assuming that our population of unweathered oils is representative. In actual spill cases there are usually a limited number of suspects, so that the probability of identification would be much higher. Furthermore, by using several analytical methods, the probability of obtaining the correct identification should approach 1.0.

TABLE XXI. Example of Ratio Method with Closeness of Match for an Actual Spill Case. The first 15 oils are crudes, #417 is a No. 2 fuel, and the last 11 are No. 5 and No. 6 fuels. Samples 623 and 624 were both taken from the tanker which was responsible for the spill.

Ident. No.	Number of Bands Within Limits*			S^2	Probability	Cor. Coef.
	5%	10%	25%			
135000	7	14	15	0.0847	0.8963	0.929
137000	6	9	14	0.2124	0.6245	0.779
140000	5	7	15	0.2388	0.5766	0.772
149000	8	10	15	0.0930	0.8788	0.923
152000	7	10	15	0.0829	0.9002	0.904
161000	9	11	17	0.0455	0.9676	0.977
171000	8	11	17	0.0765	0.9132	0.956
172000	4	9	17	0.0512	0.9590	0.957
174000	4	5	15	0.1490	0.7548	0.839
177000	5	8	16	0.0896	0.8860	0.953
178000	11	14	17	0.0434	0.9705	0.989
188000	7	11	16	0.0662	0.9331	0.960
191000	10	10	16	0.0431	0.9710	0.958
192000	4	6	15	0.0929	0.8790	0.864
213000	6	8	14	0.1762	0.6966	0.813
417000	2	5	12	0.1430	0.7680	0.849
603000	6	11	15	0.0934	0.8779	0.928
605000	3	4	11	0.2685	0.5274	0.887
607000	5	6	13	0.1762	0.6965	0.859

TABLE XXI.- Continued

Ident No.	Number of Bands Within Limits*			S^2	Probability	Cor. Coef.
	5%	10%	25%			
612000	8	11	17	0.0574	0.9488	0.963
616000	3	5	12	0.1477	0.7577	0.889
617000	3	4	11	0.2491	0.5590	0.855
618000	1	2	6	0.4244	0.3382	0.777
622000	6	11	17	0.0842	0.8976	0.968
623000	15	17	18	0.0078	0.9994	0.993
624000	14	18	18	0.0052	0.9998	0.996
626000	8	10	17	0.0047	0.9535	0.945

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APPENDIX I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OIL

Legend:

Unweathered Oil Identification Numbers - 3 digits.
The first digit indicates the type of oil,
- 1 & 2 = crudes
- 3 = kerosene
- 4 = No. 2 and No. 4 fuel oils
- 6 = No. 6 fuel oil
- 7 = diesel
- 8 = lubricating oil

Weathered Oil Identification Numbers - 6 digits.
The first three are the same as those of the known (unweathered) oil
- 4th digit - weathering location
  - 1 = Narragansett Bay
  - 2 = Roof of laboratory
  - 3 = In-laboratory
  - 4 = Aquarium
- 5th digit - used to distinguish the same oil weathered repeatedly
- 6th digit - length of weathering time
  - 1 = shortest length of time (generally 48 hrs)
  - 2 = second sample (generally 168 hrs)
  - 3 = third sample (generally 336 hrs)

Cloud Cover 1-5 for outside weathering (average conditions)
- 1 = rain
- 2 = cloudy
- 3 = partly cloudy
- 4 = partly sunny
- 5 = sunny

0 for laboratory - refers to total illumination, no illumination, or 12 hr/day illumination. These three conditions can be determined from the Lab Conditions

6-24 number of hours of illumination in the laboratory per day

Lab Conditions
- 1 = fresh water
- 2 = salt water
- 3 = artificial wind
- 4 = continuous illumination
- 5 = intermittent illumination
- 6 = aeration

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
101	CRUDE	1	ROCKY MT. U.S.A.	12/72
102	CRUDE	1	MID EAST (IRAN)	12/72
103	CRUDE	1	ES SIDER,N. AFRICA	12/72
104	CRUDE	1	MID EAST (ARABIA)	12/72
105	CRUDE	1	MATA, SOUTH AMERICA	12/72
106	CRUDE	1	ORITO, SOUTH AMERICA	12/72
107	CRUDE	1	SIRTICA, NORTH AFRICA	12/72
108	CRUDE	1	AMNA, NORTH AFRICA	12/72
109	CRUDE	1	ROCKY MT. U.S.A.	12/72
110	CRUDE	2	ZAIRE, AFRICA	1/73
111	CRUDE	2	AGHA JARI	1/73
112	CRUDE	2	CABINDA	1/73
113	CRUDE	2	MYSTERY	1/73
114	CRUDE	2	NIGERIA	1/73
115	CRUDE	2	KUWAIT	1/73
116	CRUDE	2	DELTA, U.S.A.	1/73
117	CRUDE	2	JAY SMACKOVER	1/73
118	CRUDE	3	ALBERTA, CANADA	9/73
119	CRUDE	3	HEIDELBURG, MISSISSIPPI	9/73
120	CRUDE	3	BELL CREEK, MONTANA	9/73
122	CRUDE	3	WILMINGTON, CALIFORNIA	9/73
123	CRUDE	3	RED WASH, UTAH	9/73
124	CRUDE	3	KATELLA, ALASKA	9/73
125	CRUDE	3	GACH SARAN, IRAN	9/73
126	CRUDE	3	RECLUSE, WYOMING	9/73
127	CRUDE	4	RED WASH, UTAH	9/73
128	CRUDE	4	RECLUSE, WYOMING	9/73
129	CRUDE	4	ALBERTA, CANADA	9/73
130	CRUDE	4	WASSON, TEXAS	9/73
131	CRUDE	4	PRUDHOE BAY, ALASKA	9/73
132	CRUDE	4	WILMINGTON, CALIFORNIA	9/73
133	CRUDE	4	GACH SARAN, IRAN	9/73
134	CRUDE	5	LOUISANNA	3/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
134331	48	7/17/75	26	22	0	0	2,5,6
134332	168	7/22/75	26	22	0	0	2,5,6
134333	336	7/29/75	26	22	0	0	2,5,6
134491	48	7/11/75	25	22	10	4	0,0,0
134492	168	7/16/75	28	24	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
135	CRUDE	1	NORTH AFRICA (ES SIDER)	10/73
136	CRUDE	1	NORTH AFRICA (SIRTICA)	12/73
138	CRUDE	1	NORTH AFRICA (ES SIDER)	10/73
140	CRUDE	1	NORTH AFRICA (AMNA)	10/73

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
141	CRUDE	1	NORTH AFRICA (AMNA)	10/73
142	CRUDE	1	ARABIA	10/73
147	CRUDE	1	NORTH AFRICA (AMNA)	10/73
148	CRUDE	1	NORTH AFRICA (SIRTICA)	10/73
150	CRUDE	1	NORTH AFRICA (AMNA)	12/73

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
150101	48	5/10/74	10	13	13	4	0,0,0
150102	168	5/15/74	12	13	16	4	0,0,0
150103	336	5/22/74	17	14	13	4	0,0,0
150201	48	5/10/74	15	10	6	4	0,0,0
150202	168	5/15/74	16	15	5	4	0,0,0
150203	336	5/22/74	20	18	5	4	0,0,0
150341	48	8/14/75	26	22	0	0	2,5,6
150342	168	8/19/75	25	23	0	0	2,5,6
150343	336	8/26/75	23	22	0	0	2,5,6
150391	48	5/21/75	20	18	0	0	2,5,0
150392	168	5/26/75	21	19	0	0	2,5,0
150393	336	6/ 3/75	23	20	0	0	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
151	CRUDE	1	NORTH AFRICCA(AMNA)	10/73
152	CRUDE	1	NORTH AFRICA (SIRTICA)	12/73

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
152101	48	6/20/74	26	20	13	3	0,0,0
152103	336	7/24/74	26	22	13	3	0,0,0
152104	774	7/12/74	27	21	14	3	0,0,0
152105	894	7/17/74	27	21	12	3	0,0,0
152106	1062	7/24/74	26	22	13	3	0,0,0
152202	168	6/25/74	25	26	4	3	0,0,0
152203	336	7/ 2/74	23	24	4	3	0,0,0
152204	774	7/12/74	25	24	6	3	0,0,0
152311	48	7/31/74	23	19	0	8	2,5,0
152312	168	8/ 4/74	21	21	0	22	2,5,0
152313	336	8/12/74	23	20	0	17	2,5,0
152321	48	8/23/74	27	21	0	24	2,5,0
152322	168	8/28/74	26	21	0	20	2,5,0
152323	336	9/ 4/74	24	21	0	28	2,5,0
152324	816	9/26/74	19	15	0	13	2,5,0
152325	936	10/ 1/74	19	15	0	13	2,5,0
152326	1104	10/ 8/74	19	15	0	13	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
153	CRUDE	6	KUWAIT	0/ 0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
153391	48	5/21/75	20	18	0	0	2,5,0
153392	168	5/26/75	21	19	0	0	2,5,0
153393	336	6/ 3/75	23	20	0	0	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
154	CRUDE	6	SOUTH LOUISANNA	0/ 0
155	CRUDE	7	GULF COAST	1/73
156	CRUDE	7	E. TEXAS & W. LOUISANNA	1/73
157	CRUDE	8	LAGOMEDIO	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
157201	48	4/20/74	12	12	4	4	0,0,0
157203	336	5/ 5/74	18	14	4	3	0,0,0
157331	48	7/17/75	26	22	0	0	2,5,6
157332	168	7/22/75	26	22	0	0	2,5,6
157333	336	7/29/75	26	22	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
158	CRUDE	8	WEST TEXAS	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
158101	48	4/20/74	17	10	14	4	0,0,0
158102	168	4/25/74	16	10	15	2	0,0,0
158202	168	4/25/74	14	14	4	2	0,0,0
158203	336	5/ 5/74	18	14	4	3	0,0,0
158321	48	7/ 3/75	26	22	0	0	2,5,6
158322	168	7/ 8/75	25	21	0	0	2,5,6
158323	336	7/15/75	25	21	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
159	CRUDE	9	LOUISANNA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
159381	48	4/18/75	23	21	0	0	2,5,6
159382	168	4/23/75	22	20	0	0	2,5,6
159383	336	4/30/75	22	21	0	0	2,5,6
159411	48	8/ 7/75	26	23	15	1	0,0,0
159412	168	8/12/75	30	26	8	5	0,0,0
159413	336	8/19/75	32	30	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
160	CRUDE	9	LOUISANNA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
160101	48	4/20/74	17	10	14	4	0,0,0
160102	168	4/25/74	16	10	15	2	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
160202	168	4/25/74	14	14	4	2	0,0,0
160203	336	5/ 5/74	18	14	4	3	0,0,0
160321	48	7/ 3/75	26	22	0	0	2,5,6
160322	168	7/ 8/75	25	21	0	0	2,5,6
160323	336	7/15/75	25	21	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
161	CRUDE	10	ALASKA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
161101	48	4/20/74	17	10	14	4	0,0,0
161102	168	4/25/74	16	10	15	2	0,0,0
161104	480	5/ 9/74	10	13	13	4	0,0,0
161105	816	5/21/74	17	14	13	4	0,0,0
161107	1008	6/ 1/74	17	16	10	3	0,0,0
161109	1128	6/ 6/74	19	17	12	4	0,0,0
161201	48	4/20/74	12	12	4	4	0,0,0
161202	168	4/25/74	14	14	4	2	0,0,0
161203	336	5/ 5/74	18	14	4	3	0,0,0
161204	480	5/10/74	15	10	6	4	0,0,0
161208	1128	6/ 6/74	23	22	5	4	0,0,0
161209	1296	6/13/74	23	26	5	3	0,0,0
161331	48	7/17/75	26	22	0	0	2,5,6
161332	168	7/22/75	26	22	0	0	2,5,6
161333	336	7/29/75	26	22	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
162	CRUDE	10	VENICE, LOUISANNA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
162101	48	8/ 1/74	24	24	10	4	0,0,0
162102	168	8/ 6/74	26	23	12	4	0,0,0
162201	48	8/ 1/74	29	25	5	3	0,0,0
162202	168	8/ 6/74	29	27	6	3	0,0,0
162203	336	8/13/74	27	26	4	4	0,0,0
162301	48	8/23/74	27	21	0	24	2,5,0
162302	168	8/28/74	26	21	0	20	2,5,0
162303	336	9/ 4/74	25	21	0	28	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
163	CRUDE	10	NIGERIA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
163101	48	4/20/74	10	17	14	4	0,0,0
163102	168	4/25/16	10	15	20	0	0,0,0
163201	48	4/20/74	12	12	4	4	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
163202	168	4/25/74	14	14	4	2	0,0,0
163203	336	5/ 5/74	18	14	4	3	0,0,0
163331	48	7/17/75	26	22	0	0	2,5,6
163332	168	7/22/75	26	22	0	0	2,5,6
163333	336	7/29/75	26	22	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
164	CRUDE	10	ZAKUM	4/74
165	CRUDE	10	ARABIA	4/74
166	CRUDE	10	IRAN	4/74
167	CRUDE	11	ARABIA	4/74
168	CRUDE	11	GULF OF MEXICO	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
168101	48	6/20/74	26	20	13	3	0,0,0
168201	48	6/20/74	26	25	5	3	0,0,0
168202	168	6/25/74	25	26	4	3	0,0,0
168331	48	7/17/75	26	22	0	0	2,5,6
168332	168	7/22/75	26	22	0	0	2,5,6
168333	336	7/29/75	26	22	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
169	CRUDE	11	LAGOMEDIO, VENEZUALA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
169101	48	7/12/74	27	21	14	3	0,0,0
169102	168	7/17/74	27	21	12	3	0,0,0
169103	336	7/24/74	26	22	13	3	0,0,0
169201	48	7/12/74	25	24	6	3	0,0,0
169203	336	7/24/74	26	28	3	3	0,0,0
169301	48	7/31/74	23	19	0	8	2,5,0
169302	168	8/ 4/74	21	21	0	22	2,5,0
169303	336	8/12/74	23	20	0	17	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
170	CRUDE	11	VENEZUALA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
170201	48	7/12/74	25	24	6	3	0,0,0
170203	336	7/24/74	26	28	3	3	0,0,0
170301	48	7/31/74	23	19	0	8	2,5,0
170302	168	8/ 4/74	21	21	0	22	2,5,0
170303	336	8/12/74	23	20	0	17	2,5,0
170481	48	6/20/75	29	23	11	5	0,0,0
170482	168	6/25/75	29	25	12	5	0,0,0
170483	336	7/ 2/75	29	25	4	5	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
171	CRUDE	11	ECUADOR & ORIENTE MIX	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
171101	48	8/ 1/74	24	24	10	4	0,0,0
171102	168	8/ 6/74	26	23	12	4	0,0,0
171103	336	8/13/74	26	23	11	4	0,0,0
171201	48	8/ 1/74	29	25	5	3	0,0,0
171202	168	8/ 6/74	29	27	6	3	0,0,0
171203	336	8/13/74	27	26	4	4	0,0,0
171301	48	8/23/74	27	21	0	24	2,5,0
171302	168	8/28/74	26	21	0	20	2,5,0
171303	336	9/ 4/74	24	21	0	28	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
172	CRUDE	11	VENEZUALA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
172101	48	6/ 1/74	17	16	10	3	0,0,0
172102	168	6/ 6/74	19	17	12	4	0,0,0
172103	336	6/13/74	22	17	12	3	0,0,0
172201	48	6/ 1/74	20	18	4	3	0,0,0
172202	168	6/ 6/74	23	22	5	4	0,0,0
172203	336	6/13/74	23	26	5	3	0,0,0
172311	48	9/26/74	19	15	0	13	2,5,0
172312	168	10/ 1/74	19	15	0	13	2,5,0
172313	336	10/ 8/74	19	15	0	13	2,5,0
172321	48	12/17/74	23	17	5	12	2,3,5
172322	168	12/22/74	23	17	5	12	2,3,5
172331	48	1/22/75	17	12	0	24	2,5,0
172332	168	1/27/75	18	12	0	24	2,5,0
172333	336	2/ 3/75	18	12	0	13	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
173	CRUDE	11	OFF-SHORE, NIGERIA	4/74
174	CRUDE	11	OFF-SHORE CALIF. VENTURA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
174101	48	6/ 1/74	17	16	10	3	0,0,0
174102	168	6/ 6/74	19	17	12	4	0,0,0
174103	336	6/13/74	22	17	12	3	0,0,0
174201	48	6/ 1/74	20	18	4	3	0,0,0
174202	168	6/ 6/74	23	22	5	4	0,0,0
174203	336	6/13/74	23	26	5	3	0,0,0
174311	48	9/26/74	19	15	0	13	2,5,0
174312	168	10/ 1/74	19	15	0	13	2,5,0
174313	336	10/ 8/74	19	15	0	13	2,5,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
174321	48	12/17/74	23	17	5	12	2,3,5
174322	168	12/22/74	23	17	5	12	2,3,5

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
175	CRUDE	2	ECUADOR	1/73
176	CRUDE	2	MEREY	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
176101	48	5/10/74	10	13	13	4	0,0,0
176103	336	5/22/74	17	14	15	4	0,0,0
176201	48	5/10/74	15	10	6	4	0,0,0
176203	336	5/22/74	20	18	5	4	0,0,0
176321	48	7/ 3/75	26	22	0	0	2,5,6
176322	168	7/ 8/75	25	21	0	0	2,5,6
176323	336	7/15/75	25	21	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
177	CRUDE	2	ECUADOR	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
177101	48	6/ 1/74	17	16	10	3	0,0,0
177102	168	6/ 6/74	19	16	12	4	0,0,0
177103	336	6/13/74	22	17	12	3	0,0,0
177201	48	6/ 1/74	20	18	4	3	0,0,0
177202	168	6/ 6/74	23	22	5	4	0,0,0
177203	336	6/13/74	23	26	5	3	0,0,0
177311	48	8/23/74	27	21	0	24	2,5,0
177312	168	8/28/74	26	21	0	20	2,5,0
177313	336	9/ 4/74	24	21	0	28	2,5,0
177321	48	12/17/74	23	17	5	12	2,3,5
177322	168	12/22/74	23	17	5	12	2,3,5
177331	48	1/22/75	17	12	0	24	2,5,0
177332	168	1/27/75	18	12	0	24	2,5,0
177333	336	2/ 3/75	18	12	0	13	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
178	CRUDE	2	MESA, E. VENEZUALA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
178101	48	7/12/74	27	21	14	3	0,0,0
178102	168	7/17/74	27	21	12	3	0,0,0
178103	336	7/24/74	26	22	13	3	0,0,0
178201	48	7/12/74	25	24	6	3	0,0,0
178202	168	7/17/74	28	28	4	3	0,0,0
178203	336	7/24/74	26	28	3	3	0,0,0
178301	48	7/31/74	23	19	0	8	2,5,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
178302	168	8/ 4/74	21	21	0	22	2,5,0
178303	336	8/12/74	23	20	0	17	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
179	CRUDE	2	CABINDA, OFF-SHORE, AFRI	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
179101	48	7/12/74	27	21	14	3	0,0,0
179102	168	7/17/74	27	21	12	3	0,0,0
179103	336	7/24/74	26	22	13	3	0,0,0
179201	48	7/12/74	25	24	6	3	0,0,0
179202	168	7/17/74	28	28	4	3	0,0,0
179203	336	7/24/74	26	28	3	3	0,0,0
179301	48	7/31/74	23	19	0	8	2,5,0
179302	168	8/ 4/74	21	21	0	22	2,5,0
179303	336	8/12/74	23	20	0	17	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
180	CRUDE	2	MIXED OFF-ONSHORE, CALIF	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
180101	48	5/10/74	10	13	13	4	0,0,0
180103	336	5/22/74	17	14	15	4	0,0,0
180331	48	7/17/75	26	22	0	0	2,5,6
180332	168	7/22/75	26	22	0	0	2,5,6
180333	336	7/29/75	26	22	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
181	CRUDE	2	OFF-SHORE, ZAIRE	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
181101	48	6/ 1/74	17	16	10	3	0,0,0
181102	168	6/ 6/74	20	17	12	4	0,0,0
181103	336	6/13/74	22	17	12	3	0,0,0
181201	48	6/ 1/74	20	18	4	3	0,0,0
181202	168	6/ 6/74	23	22	5	4	0,0,0
181203	336	6/13/74	23	26	5	3	0,0,0
181311	48	9/26/74	19	15	0	13	2,5,0
181312	168	10/ 1/74	19	15	0	13	2,5,0
181313	336	10/ 8/74	19	15	0	13	2,5,0
181321	48	12/17/74	23	17	5	12	2,3,5
181322	168	12/22/74	23	17	5	12	2,3,5
181331	48	1/22/75	17	12	0	24	2,5,0
181332	168	1/27/75	18	12	0	24	2,5,0
181333	336	2/ 3/75	18	12	0	13	2,5,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
182	CRUDE	1	EAST AFRICA	12/72
183	CRUDE	1	BACHQUERO	5/74
184	CRUDE	18	GACH SARAN	5/74
185	CRUDE	18	SOUTH AMERICA	5/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
185101	48	7/12/74	27	21	14	3	0,0,0
185102	168	7/17/74	27	21	12	3	0,0,0
185103	336	7/24/74	26	22	13	3	0,0,0
185201	48	7/12/74	25	24	6	3	0,0,0
185202	168	7/17/74	28	28	4	3	0,0,0
185203	336	7/24/74	26	28	3	3	0,0,0
185301	48	7/31/74	23	19	0	8	2,5,0
185302	168	8/ 4/74	21	21	0	22	2,5,0
185303	336	8/12/74	23	20	0	17	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
186	CRUDE	18	TRANS MOUNTAIN MIX	5/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
186311	48	6/12/75	26	22	0	0	2,4,6
186312	168	6/17/75	26	22	0	0	2,4,6
186313	336	6/24/75	26	22	0	0	2,4,6
186321	48	7/ 3/75	26	22	0	0	2,5,6
186322	168	7/ 8/75	25	21	0	0	2,5,6
186323	336	7/15/75	25	21	0	0	2,5,6
186381	48	4/18/75	23	21	0	0	2,5,6
186382	168	4/23/75	22	20	0	0	2,5,6
186383	336	4/30/75	22	21	0	0	2,5,6
186391	48	5/21/75	20	18	0	0	2,5,0
186392	168	5/26/75	21	19	0	0	2,5,0
186393	336	6/ 3/75	23	20	0	0	2,5,0
186411	48	8/ 7/75	26	23	15	1	0,0,0
186412	168	8/12/75	30	26	8	5	0,0,0
186431	48	8/29/75	28	26	10	4	0,0,0
186461	48	4/30/75	14	10	9	5	0,0,0
186462	168	5/ 5/75	8	10	18	1	0,0,0
186463	336	5/12/75	16	12	12	5	0,0,0
186471	48	5/29/75	26	18	9	5	0,0,0
186472	168	6/ 3/75	22	17	4	5	0,0,0
186473	336	6/10/75	25	18	10	5	0,0,0
186481	48	6/20/75	29	23	4	5	0,0,0
186482	168	6/25/75	29	25	12	5	0,0,0
186483	336	7/ 2/75	29	25	4	5	0,0,0
186491	48	7/11/75	25	22	10	4	0,0,0
186492	168	7/16/75	28	24	8	5	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
186493	336	7/23/75	30	25	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
187	CRUDE	37	VENEZUALA	8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
187301	48	3/12/75	21	19	0	8	2,5,0
187302	168	3/17/75	20	18	0	8	2,5,0
187303	336	3/24/75	21	19	0	8	2,5,0
187442	168	3/25/75	9	7	10	2	0,0,0
187483	336	7/ 2/75	29	25	4	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
188	CRUDE	40	MID EAST	8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
188301	48	3/12/75	21	19	0	8	2,5,0
188302	168	3/17/75	20	18	0	8	2,5,0
188303	336	3/24/75	21	19	0	8	2,5,0
188441	48	3/20/75	6	5	10	3	0,0,0
188481	48	6/20/75	29	23	11	5	0,0,0
188483	336	7/ 2/75	29	25	4	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
189	CRUDE	27	ALASKA	8/74
190	CRUDE	24	FAR EAST	8/74
191	CRUDE	23	EUROPE	8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
191301	48	3/12/75	21	19	0	8	2,5,0
191302	168	3/17/75	20	18	0	8	2,5,0
191303	336	3/24/75	21	19	0	8	2,5,0
191481	48	6/20/75	29	23	4	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
192	CRUDE	39	DOMESTIC	8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
192301	48	3/12/75	21	19	0	8	2,5,0
192302	168	3/17/75	20	18	0	8	2,5,0
192303	336	3/24/75	21	19	0	8	2,5,0
192451	48	4/ 4/75	0	7	20	2	0,0,0
192481	48	6/20/75	29	23	4	5	0,0,0
192482	168	6/25/75	29	25	12	5	0,0,0
192483	336	7/ 2/75	29	25	4	5	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
193	CRUDE	1	AMNA	12/74
194	CRUDE	1	SIRTICA	12/74
195	CRUDE	1	IRAN	12/74
196	CRUDE	1	MARJAN	12/74
197	CRUDE	1	KOTLA	12/74
198	CRUDE	1	MINAS	12/74
199	CRUDE	1	BAHI AMAL	12/74
200	CRUDE	1	DOR	12/74
201	CRUDE	1	NAFOORA AUGILA	12/74
202	CRUDE	1	ARABIAN MED.	12/74
203	CRUDE	1	NAFOORA	12/74
204	CRUDE	1	BREGA	12/74
205	CRUDE	1	HARAM	12/74
206	CRUDE	1	NIGERIA	12/74
207	CRUDE	1	BEDA	12/74
208	CRUDE	1	BUALAWN	12/74
209	CRUDE	1	WARID	12/74
210	CRUDE	1	ZUEITINA	12/74
211	CRUDE	1	SHALLOW	12/74
212	CRUDE	1	BREGA	12/74
213	CRUDE	1	NEPCO GALLANT	12/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
213121	48	1/28/75	2	4	13	2	0,0,0
213122	168	2/ 2/75	1	4	10	2	0,0,0
213301	48	1/22/75	17	12	0	24	2,5,0
213302	168	1/27/75	18	12	0	24	2,5,0
213303	336	2/ 3/75	18	12	0	13	2,5,0
213311	48	6/12/75	26	22	0	0	2,4,6
213312	168	6/17/75	26	22	0	0	2,4,6
213313	336	6/24/75	26	22	0	0	2,4,6
213321	48	7/ 3/75	26	22	0	0	2,5,6
213322	168	7/ 8/75	25	21	0	0	2,5,6
213323	336	7/16/75	25	21	0	0	2,5,6
213391	48	5/21/75	20	18	0	0	2,5,0
213392	168	5/26/75	21	19	0	0	2,5,0
213393	336	6/ 3/75	23	20	0	0	2,5,0
213411	48	1/17/75	0	6	11	4	0,0,0
213412	168	1/22/75	0	4	12	3	0,0,0
213413	336	1/29/75	0	4	11	2	0,0,0
213421	48	1/28/75	2	4	13	2	0,0,0
213422	168	2/ 2/75	1	4	10	2	0,0,0
213423	336	2/ 9/75	0	4	10	2	0,0,0
213431	48	2/ 5/75	0	4	10	3	0,0,0
213432	168	2/10/75	0	4	10	3	0,0,0
213433	552	2/26/75	0	4	10	2	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
213434	720	3/ 6/75	0	4	10	3	0,0,0
213441	48	3/20/75	6	5	10	3	0,0,0
213442	168	3/25/75	9	7	10	2	0,0,0
213443	336	4/ 1/75	4	7	12	3	0,0,0
213451	48	4/ 4/75	0	7	20	2	0,0,0
213452	168	4/ 9/75	0	7	12	3	0,0,0
213453	336	4/16/75	5	7	18	1	0,0,0
213461	48	4/30/75	14	10	9	5	0,0,0
213462	168	5/ 5/75	8	10	18	1	0,0,0
213463	336	5/12/75	16	12	12	5	0,0,0
213471	48	5/29/75	26	18	9	5	0,0,0
213472	168	6/ 3/75	22	17	4	5	0,0,0
213473	336	6/10/75	25	18	10	5	0,0,0
213481	48	6/20/75	29	23	4	5	0,0,0
213482	168	6/25/75	29	24	15	5	0,0,0
213483	336	7/ 2/75	29	25	14	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
301	KEROSENE	2	ECUADOR	1/73
302	KEROSENE	2	ZAIRE	1/73
303	KEROSENE	2	AGHA JARA	1/73
304	KEROSENE	2	DELTA	1/73
305	KEROSENE	12	GRINNELL	7/73
306	NO.1FUEL	11		4/74
307	KEROSENE	2	CABINDA	1/73
308	K	0	PROVIDENCE	6/74
309	KEROSENE	11	PROVIDENCE	6/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
309101	48	6/20/74	26	20	13	3	0,0,0
309201	48	6/20/74	26	25	5	3	0,0,0
309331	48	7/17/75	26	22	0	2	5,6,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
310	KEROSENE	48	PROVIDENCE	4/75
401	NO.2FUEL	2	CABINDA	1/73
402	NO.2FUEL	2	ZAIRE	1/73
403	NO.2FUEL	2	ECUADOR	1/73

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
403331	48	7/17/75	26	22	0	0	2,5,6
403333	336	7/29/75	26	22	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
404	NO.2FUEL	2	DELTA	1/73
405	NO.2FUEL	13	MOBIL	10/73

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
406	NO.2FUEL	6		0/ 0
407	NO.2FUEL	8	LAGOMEDIO	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
407341	48	8/14/75	26	22	0	0	2,5,6
407342	168	8/19/75	25	23	0	0	2,5,6
407343	336	8/26/75	23	22	0	0	2,5,6
407461	48	4/30/75	14	10	3	5	0,0,0
407462	168	5/ 5/75	14	10	15	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
408	NO.2FUEL	8	WEST TEXAS	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
408101	48	8/ 1/74	24	24	10	4	0,0,0
408102	168	8/ 6/74	26	23	12	4	0,0,0
408201	48	8/ 1/74	29	25	5	3	0,0,0
408311	48	8/23/74	27	21	0	24	2,5,0
408312	168	8/28/74	26	21	0	20	2,5,0
408313	336	9/ 4/74	24	21	0	28	2,5,0
408321	48	12/17/74	23	17	5	12	2,3,5
408322	168	12/22/74	23	17	5	12	2,3,5

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
409	NO.2FUEL	11		4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
409101	48	5/10/74	10	13	13	4	0,0,0
409201	48	5/10/74	15	10	6	4	0,0,0
409202	168	5/15/74	16	15	5	4	0,0,0
409301	48	9/26/74	19	15	0	13	2,5,0
409302	168	10/ 1/74	19	15	0	13	2,5,0
409303	336	10/ 8/74	19	15	0	13	2,5,0
409491	48	5/ 9/75	10	13	13	40	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
410	NO.2FUEL	2	AGHA JARI	1/73
411	FURNACE	14	PROVIDENCE	6/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
411201	48	7/12/74	25	24	6	3	0,0,0
411301	48	7/31/74	23	19	0	8	2,5,0
411302	168	8/ 4/74	21	21	0	22	2,5,0
411303	336	8/12/74	23	20	0	17	2,5,0

AD-A040 975 RHODE ISLAND UNIV KINGSTON DEPT OF CHEMISTRY F/G 17/5

IDENTIFICATION OF OIL SLICKS BY INFRARED SPECTROSCOPY.(U)

AUG 76 C W BROWN, P F LYNCH, M AHMADJIAN DOT-CG-81-74-1099

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TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
412	DIESEL	14	PROVIDENCE	6/74

UNKNOWN	WEATHER	SAMPLE	TEMP		WIND	CLOUD	LAB
	TIME HRS	DATE	AIR	H20	KPH	COVER	COND
412341	48	8/14/75	26	22	0	0	2,5,6
412342	168	8/19/75	25	23	0	0	2,5,6
412343	336	8/26/75	23	22	0	0	2,5,6
412421	48	8/22/75	29	27	9	5	0,0,0
412422	168	8/27/75	32	31	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
413	DIESEL	7	PROVIDENCE	6/74

UNKNOWN	WEATHER	SAMPLE	TEMP		WIND	CLOUD	LAB
	TIME HRS	DATE	AIR	H20	KPH	COVER	COND
413101	48	6/20/74	26	20	13	3	0,0,0
413201	48	6/20/74	26	25	5	3	0,0,0
413301	48	7/31/74	23	19	0	8	2,5,0
413302	168	8/ 4/74	21	21	0	22	2,5,0
413303	336	8/12/74	23	20	0	17	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
414	NO. 2	2	PROVIDENCE	6/74

UNKNOWN	WEATHER	SAMPLE	TEMP		WIND	CLOUD	LAB
	TIME HRS	DATE	AIR	H20	KPH	COVER	COND
414101	48	6/20/74	26	20	13	3	0,0,0
414201	48	6/20/74	26	25	5	3	0,0,0
414202	168	6/25/74	25	26	4	3	0,0,0
414331	48	7/17/75	26	22	0	0	2,5,6
414333	336	7/29/75	26	22	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
415	NO.2FUEL	40		8/74
416	M.DIESEL	39		8/74

UNKNOWN	WEATHER	SAMPLE	TEMP		WIND	CLOUD	LAB
	TIME HRS	DATE	AIR	H20	KPH	COVER	COND
416341	48	8/14/75	26	22	0	0	2,5,6
416342	168	8/19/75	25	23	0	0	2,5,6
416343	336	8/26/75	23	22	0	0	2,5,6
416411	48	8/ 7/75	26	23	15	1	0,0,0
416412	168	8/12/75	30	26	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
417	NO.4FUEL	7		8/74

UNKNOWN	WEATHER	SAMPLE	TEMP		WIND	CLOUD	LAB
	TIME HRS	DATE	AIR	H20	KPH	COVER	COND
417301	48	3/12/75	21	19	0	8	2,5,0
417302	168	3/17/75	20	18	0	8	2,5,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
417303	336	3/24/75	21	19	0	8	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
418	NO.4FUEL	40		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
418301	48	3/12/75	21	19	0	8	2,5,0
418302	168	3/17/75	20	18	0	8	2,5,0
418303	336	3/24/75	21	19	0	8	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
419	DIESEL	7	NEWARK	8/74
420	#2M.FUEL	42	M.V.ARION	8/74
421	NO.2FUEL	41		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
421301	48	1/22/75	17	12	0	24	2,5,0
421311	48	10/24/74	20	16	0	14	2,5,0
421312	168	10/29/74	19	16	0	12	2,5,0
421313	336	11/ 5/74	20	16	0	12	2,5,0
421321	48	7/ 3/75	26	22	0	0	2,4,6
421322	168	7/ 8/75	25	21	0	0	2,5,6
421331	48	6/12/75	26	22	0	2	4,6,0
421391	48	5/21/75	20	18	0	0	2,5,0
421411	24	7/27/75	29	25	11	50	0,0,0
421421	24	11/25/75	5	9	5	20	0,0,0
421422	48	11/26/75	7	10	3	20	0,0,0
421423	168	12/ 1/75	15	12	2	10	0,0,0
421431	24	11/25/75	7	10	5	20	0,0,0
421432	48	11/26/75	7	10	3	20	0,0,0
421433	168	12/ 1/75	15	12	2	10	0,0,0
421461	48	4/30/75	14	10	9	5	0,0,0
421471	48	5/29/75	26	18	9	5	0,0,0
421472	168	6/ 3/75	22	17	4	5	0,0,0
421481	48	6/20/75	29	23	4	5	0,0,0
421491	48	7/11/75	25	22	10	4	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
422	NO.4FUEL	46	PAWTUCKET	1/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
422342	168	8/19/75	25	23	0	0	2,5,0
422343	336	8/26/75	23	22	0	0	2,5,6
422431	48	2/ 5/75	0	4	10	3	0,0,0
422432	168	2/10/75	0	4	10	3	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
423	NO.4F.O.	45		4/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
423311	48	6/12/75	26	22	0	0	2,4,6
423312	168	6/17/75	26	22	0	0	2,4,6
423313	336	6/24/75	26	22	0	0	2,4,6
423321	48	7/ 3/75	26	22	0	0	2,5,6
423322	168	7/ 8/75	25	21	0	0	2,5,6
423323	336	7/15/75	25	21	0	0	2,5,6
423381	48	4/18/75	23	21	0	0	2,5,6
423382	168	4/23/75	22	20	0	0	2,5,6
423383	336	4/30/75	22	21	0	0	2,5,6
423391	48	5/21/75	20	18	0	0	2,5,0
423392	168	5/26/75	21	19	0	0	2,5,0
423393	336	6/ 3/75	23	20	0	0	2,5,0
423441	48	10/22/75	16	17	2	50	0,0,0
423451	48	4/ 4/75	0	7	20	2	0,0,0
423452	168	4/ 9/75	0	7	12	3	0,0,0
423453	336	4/16/75	5	7	18	1	0,0,0
423461	48	4/30/75	14	10	9	5	0,0,0
423462	168	5/ 5/75	8	10	18	1	0,0,0
423463	336	5/12/75	16	12	12	5	0,0,0
423471	48	5/29/75	26	18	12	5	0,0,0
423472	168	6/ 3/75	22	17	4	5	0,0,0
423473	336	6/10/75	25	18	10	5	0,0,0
423481	48	6/20/75	29	23	4	5	0,0,0
423482	168	6/25/75	29	24	15	5	0,0,0
423491	48	7/11/75	25	22	10	4	0,0,0
423492	168	7/16/75	28	24	8	5	0,0,0
423493	336	7/23/75	30	25	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
424	NO.2FUEL	48	PROVIDENCE	4/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
424491	24	7/27/75	29	25	11	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
426	API NO.2	47	TEXAS	4/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
426301	48	10/22/75	26	22	0	82	5,6,0
426302	168	10/27/75	25	23	0	82	5,6,0
426303	338	11/ 3/75	23	22	0	82	5,6,0
426461	24	5/ 4/75	8	10	18	1	0,0,0
426462	48	5/ 5/75	8	10	18	1	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
426491	24	7/27/75	29	25	11	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
427	NO.2FUEL	50	E.PROVIDENCE	8/75
428	NO.2FUEL	50	E.PROVIDENCE	8/75
429	NO.2FUEL	50	E.PROVIDENCE	8/75
430	NO.2FUEL	50	E.PROVIDENCE	8/75
431	NO.2FUEL	50	E.PROVIDENCE	8/75
432	MARINEFO	51	M.V. GRAND ENTERPRISE	9/75
501	600+	1	ES SIDER	10/73
502	600+	1	SIRTICA	10/73
503	RESIDUUM	1	ES SIDER	10/73
504	600+	1	AMNA	10/73
505	RESIDUUM	1	ARABIA	10/73
506	RESIDUUM	1	AMNA	10/73
507	RESIDUUM	1	ARABIA	10/73
508	VISBRKN	1	AMNA	10/73
509	VISBRKN	1	ARABIA	10/73
510	RESIDUUM	1	AMNA	10/73
511	RESIDUUM	2	ZAIRE	1/73
512	RESIDUUM	2	AGHA JARI	1/73
513	RESIDUUM	2	CABINDA	1/73
514	800+ BTM	1	SIRTICA	10/73
515	800+ BTM	1	AMNA	10/73
516	800+BTMO	11	S SIDER	0/73
517	800+ BTM	1	SIRTICA	10/73
518	800+ BTM	1	ES SIDER	10/73
519	800+ BTM	1	ARABIA	10/73
520	800+ BTM	1	AMNA	10/73
521	VCM BTMS	8	WEST TEXAS	4/74
522	VCM BTMS	8	MID CONTINENT	4/74
523	VCM BTMS	8	LAGOMEDIO	4/74
524	RESIDUUM	2	DELTA	1/73
525	RESIDUUM	2	ECUADOR	1/73
526	600+	1	SIRTICA	10/73
601	BUNKER C	12		7/73

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
601101	48	4/20/74	17	10	14	4	0,0,0
601201	48	4/20/74	12	12	4	4	0,0,0
601203	336	5/ 5/74	18	14	4	3	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
602	BUNKER C	14		8/73
603	BUNKER C	15	CANADA	4/73
604	NAVY SPE	16		6/73

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
605	NO.6FUEL	5		3/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
605101	48	6/ 1/74	17	16	10	3	0,0,0
605102	168	6/ 6/74	20	17	12	4	0,0,0
605103	336	6/13/74	22	17	12	3	0,0,0
605201	48	6/ 1/74	20	18	4	3	0,0,0
605202	168	6/ 6/74	23	22	5	4	0,0,0
605203	336	6/13/74	23	26	5	3	0,0,0
605311	48	9/26/74	19	15	0	13	2,5,0
605312	168	10/ 1/74	19	15	0	13	2,5,0
605313	336	10/ 8/74	19	15	0	13	2,5,0
605321	48	12/17/74	23	17	5	12	2,3,5
605322	168	12/22/74	23	17	5	12	2,3,5
605331	48	1/22/75	17	12	0	24	2,5,0
605332	168	1/27/75	18	12	0	24	2,5,0
605333	336	2/ 3/75	18	12	0	13	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
606	NO.6FUEL	17		1/73

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
606101	48	4/20/74	17	10	14	4	0,0,0
606102	168	4/25/74	16	10	15	2	0,0,0
606201	48	4/20/74	12	12	4	4	0,0,0
606203	336	5/ 5/74	18	14	4	3	0,0,0
606321	48	7/ 3/75	26	22	0	0	2,5,6
606322	168	7/ 8/75	25	21	0	0	2,5,6
606323	336	7/15/75	25	21	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
607	NO.5FUEL	2	S. AMERICA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
607101	48	6/ 1/74	17	16	10	3	0,0,0
607102	168	6/ 6/74	19	17	12	4	0,0,0
607103	336	6/13/74	22	17	12	3	0,0,0
607201	48	6/ 1/74	20	18	4	3	0,0,0
607202	168	6/ 6/74	23	22	5	4	0,0,0
607203	336	6/13/74	23	26	5	3	0,0,0
607311	48	8/23/74	27	21	0	24	2,5,0
607312	168	8/28/74	26	21	0	20	2,5,0
607313	336	9/ 4/74	24	21	0	28	2,5,0
607321	48	12/17/74	23	17	5	12	2,3,5
607322	168	12/22/74	23	17	5	12	2,3,5
607331	48	1/22/75	17	12	0	24	2,5,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
607332	168	1/27/75	18	12	0	24	2,5,0
607333	336	2/ 3/75	18	12	0	13	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
608	NO.5FUEL	2	U.S.A.	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
608101	48	5/10/74	10	13	13	4	0,0,0
608102	168	5/15/74	12	13	16	4	0,0,0
608103	336	5/22/74	17	14	15	4	0,0,0
608201	48	5/10/74	15	10	6	4	0,0,0
608202	168	5/15/74	16	15	5	4	0,0,0
608203	336	5/22/74	20	18	5	4	0,0,0
608301	48	9/26/74	19	15	0	13	2,5,0
608302	168	10/ 1/74	19	15	0	13	2,5,0
608303	336	10/ 8/74	19	15	0	13	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
609	NO.6FUEL	2	U.S.A.	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
609101	48	6/20/74	26	20	13	3	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
610	NO.6FUEL	2	S. AMERICA	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
610101	48	5/10/74	10	13	13	4	0,0,0
610103	336	5/22/74	17	14	15	4	0,0,0
610201	48	5/10/74	15	10	6	4	0,0,0
610202	168	5/15/74	16	15	5	4	0,0,0
610203	336	5/22/74	20	18	5	4	0,0,0
610301	48	9/26/74	19	15	0	13	2,5,0
610302	168	10/ 1/74	19	15	0	13	2,5,0
610303	336	10/ 8/74	19	15	0	13	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
611	BUNKER C	6		0/ 0

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
611391	48	5/21/75	20	18	0	0	2,5,0
611392	168	5/26/75	21	19	0	0	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
612	NO.6FUEL	17	U.R.I.	5/74

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
612111	48	5/10/74	10	13	13	4	0,0,0
612113	336	5/22/74	17	14	13	4	0,0,0
612121	48	6/ 1/74	17	16	10	3	0,0,0
612122	168	6/ 6/74	19	17	12	4	0,0,0
612123	336	6/13/74	22	17	12	3	0,0,0
612131	48	6/20/74	26	20	13	3	0,0,0
612133	336	7/ 2/74	23	24	4	30	0,0,0
612142	168	7/17/24	27	21	12	3	0,0,0
612143	336	7/24/74	26	22	13	3	0,0,0
612151	48	8/ 1/74	24	24	10	4	0,0,0
612152	168	8/ 6/74	26	23	12	4	0,0,0
612153	36	8/13/74	26	23	11	4	0,0,0
612212	168	5/15/74	16	15	5	4	0,0,0
612213	336	5/22/74	20	18	5	4	0,0,0
612221	48	6/ 1/74	20	18	4	3	0,0,0
612222	168	6/ 6/74	23	22	5	4	0,0,0
612223	336	6/13/74	23	26	5	3	0,0,0
612231	48	6/20/74	26	25	5	3	0,0,0
612232	168	6/25/74	25	26	4	3	0,0,0
612233	336	7/ 2/74	23	24	4	3	0,0,0
612241	48	7/12/74	25	24	6	3	0,0,0
612243	336	7/24/74	26	28	3	3	0,0,0
612251	48	8/ 1/74	29	25	5	3	0,0,0
612252	168	8/ 6/74	29	27	6	3	0,0,0
612253	336	8/13/74	27	26	4	4	0,0,0
612261	48	8/ 1/74	29	21	5	30	0,0,0
612262	168	8/ 6/74	29	20	6	30	0,0,0
612312	168	8/ 4/74	21	21	0	22	2,5,0
612313	336	8/12/74	23	20	0	17	2,5,0
612321	48	8/23/74	27	21	0	24	2,5,0
612322	168	8/28/74	26	21	0	20	2,5,0
612323	336	9/ 4/74	24	21	0	28	2,5,0
612331	48	9/26/74	19	15	0	13	2,5,0
612332	168	10/ 1/74	19	15	0	13	2,5,0
612333	336	10/ 8/74	19	15	0	13	2,5,0
612341	48	12/17/74	23	17	5	12	2,3,5
612342	168	12/22/74	23	17	5	12	2,3,5
612343	336	12/29/74	23	17	5	12	2,3,5
612351	48	12/17/74	23	17	5	2	3,5,0
612352	168	12/22/74	23	17	5	2	3,5,0
612361	48	12/17/74	23	22	5	2	3,5,0
612362	168	12/22/74	23	22	5	2	3,5,0
612371	48	12/17/74	23	17	5	2	3,0,0
612372	168	12/22/74	23	17	5	2	3,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
613	BUNKER C	18	GACH SARAN	5/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
613101	48	8/ 1/74	24	24	10	4	0,0,0
613102	168	8/ 6/74	26	23	12	4	0,0,0
613103	336	8/13/74	26	23	11	4	0,0,0
613201	48	8/ 1/74	29	25	5	3	0,0,0
613202	168	8/ 6/74	29	27	6	3	0,0,0
613203	336	8/13/74	27	26	4	4	0,0,0
613301	48	8/23/74	27	21	0	24	2,5,0
613302	168	8/28/74	26	21	0	20	2,5,0
613303	336	9/ 4/74	24	21	0	28	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
614	NO. 6	14	PROVIDENCE	6/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
614101	48	6/20/74	26	20	13	3	0,0,0
614102	168	6/25/74	21	20	12	3	0,0,0
614201	48	6/20/74	26	25	5	3	0,0,0
614203	336	7/ 2/74	23	24	4	3	0,0,0
614341	48	8/14/75	26	22	0	0	2,5,6
614342	168	8/19/75	25	23	0	0	2,5,6
614343	336	8/26/75	23	22	0	0	2,5,6

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
615	NO.6FUEL	35		8/74
616	NO.5FUEL	40		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
616371	48	3/12/75	21	19	0	8	2,5,0
616372	168	3/17/75	20	18	0	8	2,5,0
616373	336	3/24/75	21	19	0	8	2,5,0
616451	48	4/ 4/75	0	7	20	2	0,0,0
616452	168	4/ 9/75	0	7	12	3	0,0,0
616453	336	4/16/75	5	7	18	1	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
617	NO.6FUEL	40		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
617381	48	4/18/75	23	21	0	0	2,5,6
617382	168	4/23/75	22	20	0	0	2,5,6
617451	48	4/ 4/75	0	7	20	2	0,0,0
617452	168	4/ 9/75	0	7	12	3	0,0,0
617453	336	4/16/75	5	7	18	1	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
618	NO.5FUEL	39		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
618301	48	3/12/75	21	19	0	8	2,5,0
618302	168	3/17/75	20	18	0	8	2,5,0
618303	336	3/24/75	21	19	0	8	2,5,0
618401	48	10/22/75	16	17	2	30	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
619	NO.6FUEL	21		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
619381	48	4/18/75	23	21	0	0	2,5,6
619382	168	4/23/75	22	20	0	0	2,5,6
619383	336	4/30/75	22	21	0	0	2,5,6
619491	48	7/11/75	25	22	10	4	0,0,0
619492	168	7/16/75	28	24	8	5	0,0,0
619493	336	7/23/75	30	25	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
620	BUNKER C	2	MARINE	8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
620301	48	3/12/75	21	19	0	8	2,5,0
620302	168	3/17/75	20	18	0	8	2,5,0
620303	336	3/24/75	21	19	0	8	2,5,0
620441	48	3/20/75	6	5	10	3	0,0,0
620442	168	3/25/75	9	7	10	2	0,0,0
620443	336	4/ 1/75	4	7	12	3	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
621	HVY F.O.	42	OGDEN WABASH	8/74
622	HVY F.O.	42	M.V. ARION	8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
622311	48	1/22/75	17	12	0	24	2,5,0
622312	168	1/27/75	18	12	0	24	2,5,0
622313	336	2/ 3/75	18	12	0	13	2,5,0
622381	48	4/18/75	23	21	0	0	2,5,6
622382	168	4/23/75	22	20	0	0	2,5,6
622383	336	4/30/75	22	21	0	0	2,5,6
622411	48	1/17/75	0	6	11	4	0,0,0
622412	168	1/22/75	0	4	12	3	0,0,0
622413	336	1/29/75	0	4	11	2	0,0,0
622451	48	4/ 4/75	0	7	20	2	0,0,0
622452	168	4/ 9/75	0	7	12	3	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
622453	336	4/16/75	5	7	18	1	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
623	NO.6FUEL	42	MESSENIAKI BERGAN	10/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
623101	24	10/10/74	20	17	13	30	0,0,0
623102	168	10/15/74	20	17	20	40	0,0,0
623301	48	10/24/74	20	16	0	14	2,5,0
623302	168	10/29/74	19	16	0	12	2,5,0
623303	336	11/ 5/74	20	16	0	12	2,5,0
623381	48	3/28/75	21	19	0	2	5,0,0
623382	168	3/30/75	21	19	0	2	5,0,0
623451	24	4/ 3/75	0	7	20	2	0,0,0
623452	48	4/ 4/75	0	7	20	2	0,0,0
623453	168	4/ 9/75	0	7	12	3	0,0,0
623454	336	4/16/75	5	7	18	1	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
624	NO.6FUEL	42	MESSENIAKI BERGAN	10/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
624101	24	10/10/74	20	17	13	30	0,0,0
624102	168	10/15/74	20	17	20	40	0,0,0
624342	168	8/19/75	25	23	0	0	2,5,6
624343	336	8/26/75	23	22	0	0	2,5,6
624451	48	4/ 4/75	0	7	20	2	0,0,0
624452	168	4/ 9/75	0	7	12	3	0,0,0
624453	336	4/16/75	5	7	18	1	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
625	NO.6FUEL	43	PAWTUCKET, R.I.	10/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
625301	48	10/24/74	20	16	0	14	2,5,0
625302	168	10/29/74	19	16	0	12	2,5,0
625303	336	11/ 5/74	20	16	0	12	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
626	NO. 6FO	17	U.R.I.	1/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
626121	48	1/28/75	2	4	13	2	0,0,0
626122	168	2/ 2/75	1	4	10	2	0,0,0
626123	336	2/ 9/75	0	4	11	2	0,0,0
626311	48	6/12/75	26	22	0	0	2,4,6

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
626312	168	6/17/75	26	22	0	0	2,4,6
626313	336	6/24/75	26	22	0	0	2,4,6
626321	48	7/ 3/75	26	22	0	0	2,5,6
626322	168	7/ 8/75	25	21	0	0	2,5,6
626323	336	7/15/75	25	21	0	0	2,5,6
626351	48	1/22/75	17	12	0	24	2,5,0
626352	168	1/27/75	18	12	0	24	2,5,0
626353	336	2/ 3/75	18	12	0	13	2,5,0
626371	48	3/12/75	20	18	0	8	2,5,0
626372	192	3/18/75	20	18	0	8	2,5,6
626373	336	3/24/75	21	19	0	8	2,5,0
626381	48	4/18/75	23	21	0	0	2,5,6
626382	168	4/23/75	22	20	0	0	2,5,6
626383	336	4/30/75	22	21	0	0	2,5,6
626391	48	5/21/75	20	18	0	0	2,5,0
626392	168	5/26/75	21	19	0	0	2,5,0
626393	336	6/ 3/75	23	20	0	0	2,5,0
626411	48	1/17/75	0	6	11	4	0,0,0
626412	168	1/22/75	0	4	12	3	0,0,0
626413	336	1/29/75	0	4	11	2	0,0,0
626421	48	1/28/75	2	4	13	2	0,0,0
626422	168	2/ 2/75	1	4	10	2	0,0,0
626423	336	2/ 9/75	0	4	10	2	0,0,0
626431	48	2/ 5/75	0	4	10	3	0,0,0
626432	168	2/10/75	0	4	10	3	0,0,0
626433	552	2/26/75	0	4	10	2	0,0,0
626441	48	3/20/75	6	5	10	3	0,0,0
626442	168	3/25/75	9	7	10	2	0,0,0
626443	336	4/ 1/75	4	7	12	3	0,0,0
626451	48	4/ 4/75	0	7	20	2	0,0,0
626452	168	4/ 9/75	0	7	12	3	0,0,0
626453	336	4/16/75	5	7	18	1	0,0,0
626461	48	4/30/75	14	10	9	5	0,0,0
626462	168	5/ 5/75	8	10	18	1	0,0,0
626463	336	5/12/75	16	12	12	5	0,0,0
626481	48	6/20/75	29	23	4	5	0,0,0
626482	168	6/25/75	29	24	15	5	0,0,0
626483	336	7/ 2/75	29	25	14	5	0,0,0
626711	48	1/17/75	0	6	11	4	0,0,0
626712	168	1/22/75	0	4	12	3	0,0,0
626731	48	2/ 5/75	0	4	10	3	0,0,0
626732	168	2/10/75	0	4	10	3	0,0,0
626733	552	2/26/75	0	4	10	2	0,0,0
626734	552	2/26/75	1	4	10	20	0,0,0
626812	168	1/22/75	0	4	12	3	0,0,0
626813	336	1/29/75	0	4	11	2	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
626831	48	2/ 5/75	0	4	10	3	0,0,0
626832	168	2/10/75	0	4	10	3	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
627	NO.6FUEL	48	PROVIDENCE	4/75
628	NO.6FUEL	44	PROVIDENCE	7/75
629	NO.6FUEL	44	PROVIDENCE	7/75
630	NO.6FUEL	48	PROVIDENCE	7/75
701	HVYFCGAS	1		10/73
702	SAYBOLT	1		10/73
703	SAYBOLT	1		10/73
704	OIL 27	12		7/73
705	MTR OIL	12		7/73
707	OIL 33	12		7/73
708	CMPSSR	12		7/73
709	HVYVCGAS	8	MID-CONTINENT	4/74
710	VC.GAS	8	LAGOMEDIO	4/74
711	LT.NPTHA	7		1/73
712	HVYNPTHA	7		1/73
713	HVYNPTHA	7		1/73
714	LT.NPTHA	7		1/73
715	HVYNPTHA	7		1/73
716	LT.NPTHA	7		1/73
717	DIESEL	8	MIDCONTINENT	4/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
717391	48	5/21/75	20	18	0	0	2,5,0
717392	168	5/26/75	21	19	0	0	2,5,0
717393	336	6/ 3/75	23	20	0	0	2,5,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
718	HVYVCGAS	8	SOUR W. TEXAS	4/74
719	LT.CYGAS	1		10/73
801	LUBE OIL	19		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
801301	48	4/18/75	23	21	0	0	2,5,6
801302	168	4/23/75	22	20	0	0	2,5,6
801303	336	4/30/75	22	21	0	0	2,5,6
801491	48	7/11/75	25	22	10	4	0,0,0
801492	168	7/16/75	28	24	8	5	0,0,0
801493	336	7/23/75	30	25	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
802	HYDRAULC	2		8/74

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
802301	48	4/18/75	23	21	0	0	2,5,6
802302	168	4/23/75	22	20	0	0	2,5,6
802303	336	4/30/75	22	21	0	0	2,5,6
802491	48	7/11/75	25	22	10	4	0,0,0
802492	168	7/16/75	28	24	8	5	0,0,0
802493	336	7/23/75	30	25	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
803	LUBE OIL	7		8/74
804	HYDRAULC	27		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
804343	336	8/26/75	23	22	0	0	2,5,0
804411	48	8/ 7/75	26	23	15	1	0,0,0
804412	168	8/12/75	30	26	8	5	0,0,0
804413	336	8/19/75	32	30	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
805	LUBE OIL	0		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
805201	48	11/ 1/74	3	2	17	2	0,0,0
805202	168	11/ 5/74	3	2	12	5	0,0,0
805203	336	11/12/74	8	3	9	3	0,0,0
805341	48	8/14/75	26	22	0	0	2,5,6
805343	336	8/26/75	23	22	0	0	2,5,6
805411	48	8/ 7/75	26	23	15	1	0,0,0
805412	168	8/12/75	30	26	8	5	0,0,0
805413	336	8/19/75	32	30	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
806	MOTOROIL	41		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
806201	48	11/ 1/74	3	2	17	2	0,0,0
806202	168	11/ 5/74	3	2	12	5	0,0,0
806203	336	11/12/74	8	3	9	3	0,0,0
806301	48	10/24/74	20	16	0	14	2,5,0
806302	168	10/29/74	19	16	0	12	2,5,0
806303	336	11/ 5/74	20	16	0	12	2,5,0
806491	48	7/11/75	25	22	10	4	0,0,0
806492	168	7/16/75	28	24	8	5	0,0,0
806493	336	7/23/75	30	25	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
807	TRANSMSN	44		8/74

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
807201	48	11/ 1/74	3	2	17	2	0,0,0
807202	168	11/ 5/74	3	2	12	5	0,0,0
807203	336	11/12/74	8	3	9	3	0,0,0
807301	48	10/24/74	20	16	0	14	2,5,0
807302	168	10/29/74	19	16	0	12	2,5,0
807303	336	11/ 5/74	20	16	0	12	2,5,0
807491	48	7/11/75	25	22	10	4	0,0,0
807492	168	7/16/75	28	24	8	5	0,0,0
807493	336	7/23/75	30	25	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
808	MOTOROIL	7		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
808201	48	11/ 1/74	3	2	17	2	0,0,0
808202	168	11/ 5/74	3	2	12	5	0,0,0
808203	336	11/12/74	8	3	9	3	0,0,0
808301	48	10/24/74	20	16	0	14	2,5,0
808302	168	10/29/74	19	16	0	12	2,5,0
808303	336	11/ 5/74	20	16	0	12	2,5,0
808461	48	4/30/75	14	10	9	5	0,0,0
808462	168	5/ 5/75	8	10	18	1	0,0,0
808463	336	5/12/75	16	12	12	5	0,0,0
808491	48	7/11/75	25	22	10	4	0,0,0
808492	168	7/16/75	28	24	8	5	0,0,0
808493	336	7/23/75	30	25	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
809	MOTOROIL	7		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
809201	48	11/ 1/74	3	2	17	2	0,0,0
809202	168	11/ 5/74	3	2	12	5	0,0,0
809203	336	11/12/74	8	3	9	3	0,0,0
809301	48	10/24/74	20	16	0	14	2,5,0
809302	168	10/29/74	19	16	0	12	2,5,0
809303	336	11/ 5/74	20	16	0	12	2,5,0
809411	48	8/ 7/75	26	23	15	1	0,0,0
809412	168	8/12/75	30	26	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
810	II CYCLE	41		8/74

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H2O	WIND KPH	CLOUD COVER	LAB COND
810301	48	10/24/74	20	16	0	14	2,5,0
810302	168	10/29/74	19	16	0	12	2,5,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
810303	336	11/ 5/74	20	16	0	12	2,5,0
810321	48	1/22/75	17	12	0	24	2,5,0
810322	168	1/27/75	18	12	0	24	2,5,0
810323	336	2/ 3/75	18	12	0	13	2,5,0
810431	48	2/ 5/75	0	4	10	3	0,0,0
810432	168	2/10/75	0	4	10	3	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
811	LUBE OIL	7	PROVIDENCE	5/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
811311	48	6/12/75	26	22	0	0	2,4,6
811312	168	6/17/75	26	22	0	0	2,4,6
811313	336	6/24/75	26	22	0	0	2,4,6
811471	48	5/29/75	26	18	9	5	0,0,0
811472	168	6/ 3/75	22	17	4	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
812	LUBE OIL	7	PROVIDENCE	5/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
812311	48	6/12/75	26	22	0	0	2,4,6
812312	168	6/17/75	26	22	0	0	2,4,6
812313	336	6/24/75	26	22	0	0	2,4,6
812411	48	8/ 7/75	26	23	15	1	0,0,0
812412	168	8/12/75	30	26	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
813	LUBE OIL	7	PROVIDENCE	5/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
813311	48	6/12/75	26	22	0	0	2,4,6
813312	168	6/17/75	26	22	0	0	2,4,6
813313	336	6/24/75	26	22	0	0	2,4,6
813471	48	5/29/75	26	18	12	5	0,0,0
813473	336	6/10/75	25	18	10	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
814	LUBE OIL	7	PROVIDENCE	5/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
814311	48	6/12/75	26	22	0	0	2,4,6
814312	168	6/17/75	26	22	0	0	2,4,6
814313	336	6/24/75	26	22	0	0	2,4,6
814471	48	5/29/75	26	18	12	5	0,0,0
814472	168	6/ 3/75	22	17	4	5	0,0,0

TABLE AI-I. INFORMATIONAL DATA ON UNWEATHERED AND WEATHERED OILS

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
815	94GOLDEN	7	PROVIDENCE	7/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
815341	48	8/14/75	26	22	0	0	2,5,0
815343	336	8/26/75	23	22	0	0	2,5,0
815411	48	8/ 7/75	26	23	15	1	0,0,0
815412	168	8/12/75	30	26	8	5	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
816	SSR 510	7	PROVIDENCE	7/75

UNKNOWN	WEATHER TIME HRS	SAMPLE DATE	TEMP AIR	TEMP H20	WIND KPH	CLOUD COVER	LAB COND
816341	48	8/14/75	26	22	0	0	2,5,0
816342	168	8/19/75	25	23	0	0	2,5,0
816343	336	8/26/75	23	22	0	0	2,5,0
816411	48	8/ 7/75	26	23	15	1	0,0,0

KNOWN	TYPE	COMPANY	ORIGIN	DATE RECEIVED
817	150 B.S.	7	PROVIDENCE	9/75
818	510 LUBE	7	PROVIDENCE	9/75
819	96GOLDEN	7	PROVIDENCE	9/75
820	T-2 LUBE	7	PROVIDENCE	8/75
821	91GOLDEN	7	PROVIDENCE	9/75
822	T-2 LUBE	7	PROVIDENCE	8/75
823	MPM 300	7	PROVIDENCE	8/75
824	T-2 LUBE	7	PROVIDENCE	8/75
825	SUN SOLV	7	PROVIDENCE	8/75
826	150 B.S.	7	PROVIDENCE	8/75
827	150 B.S.	7	PROVIDENCE	8/75

STOP
TIME 13.68 SECS.

APPENDIX II. LISTING OF ABSORPTIVITIES OF UNWEATHERED, WEATHERED AND VACUUMED-TREATED OILS

Table AII-I. Unweathered Oils

Files	
1	Crudes
2	Crudes
3	Kerosenes
4	No. 2 and No. 4 fuels
5	Residuum
6	No. 5 and No. 6 fuels
7	Napthas and Other Oils
8	Lube Oils

Table AII-II. Weathered Oils

Files	
11	Crudes
12	Crudes
14	Kerosenes, No. 2 and No. 4 fuels
16	No. 5 and No. 6 fuels
18	Lube Oils
20	Repetitive Weathering of Oil 612
22	New Haven Oil Spill

Table AII-III Vacuum-Treated Oils.

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 1

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
101000	2.50	5.28	6.88	4.66	3.46	2.32	1.73	2.56	1.46	1.54	1.85	1.77	1.39	1.85	1.77	1.39	1.77	2.02
102000	1.88	5.25	6.19	4.75	3.83	2.60	2.40	3.36	1.77	1.86	2.24	1.86	1.35	1.77	2.88	1.77	2.34	2.44
103000	1.07	4.86	4.19	3.50	2.69	2.00	1.56	2.34	1.43	1.51	1.86	1.68	1.27	1.60	1.77	1.35	1.77	2.05
104000	1.85	5.54	6.02	5.01	3.90	2.79	2.37	3.56	1.85	1.76	2.21	1.85	1.27	1.59	2.31	1.67	2.12	2.21
105000	2.75	4.86	7.04	5.13	4.99	3.44	2.62	4.05	2.24	2.14	2.55	1.95	1.27	1.77	2.65	1.68	2.24	2.44
106000	1.50	4.33	4.70	4.40	3.42	2.71	2.30	3.49	1.68	1.77	2.24	1.86	1.27	1.77	2.14	1.51	2.14	2.34
107000	1.14	4.57	4.26	3.57	2.66	2.16	1.63	2.51	1.42	1.59	1.93	1.76	1.27	1.67	1.76	1.42	1.85	2.12
108000	1.06	6.24	4.96	3.31	2.44	1.79	1.39	1.93	1.27	1.27	1.67	1.67	1.04	1.34	1.50	1.34	1.59	1.76
109000	1.95	20.76	17.24	4.32	3.22	1.62	1.26	1.13	0.99	0.98	1.19	1.77	1.14	1.22	1.40	1.72	1.52	1.64
110000	0.92	5.32	4.55	3.63	2.66	2.14	1.58	2.73	1.45	1.53	2.09	1.80	1.12	1.45	1.53	1.28	1.62	1.90
111000	1.66	5.13	6.02	4.65	3.90	2.46	2.18	3.18	1.67	1.76	2.12	1.67	1.19	1.59	1.85	1.42	2.03	2.21
112000	1.48	4.75	5.56	4.31	3.62	2.36	1.81	3.07	1.67	1.76	2.21	1.85	1.34	1.76	1.85	1.42	1.85	2.12
113000	1.52	5.18	5.64	4.68	3.76	2.64	2.33	3.41	1.79	1.88	2.17	1.79	1.20	1.61	2.07	1.61	2.17	2.27
114000	1.95	4.75	6.27	4.48	4.05	2.57	2.18	3.18	1.85	1.85	2.21	1.85	1.42	2.03	2.21	1.67	2.12	2.41
115000	1.48	5.54	5.78	4.65	3.76	2.68	2.48	3.56	1.93	2.03	2.31	1.93	1.34	1.67	2.21	1.76	2.41	2.41
116000	1.47	4.15	4.17	3.93	3.07	2.43	1.88	3.02	1.83	1.83	2.29	2.01	1.49	1.83	1.92	1.49	2.19	2.29
117000	3.68	5.67	8.92	5.96	5.41	2.14	2.43	2.97	1.46	1.31	1.69	1.54	1.39	1.85	1.93	1.39	1.69	2.19
118000	1.51	4.68	5.76	4.46	3.72	2.31	1.91	3.56	1.72	1.87	2.19	1.87	1.50	1.87	1.95	1.57	2.11	2.36
119000	1.31	5.54	5.15	4.82	3.76	2.90	2.91	4.12	2.21	2.31	2.84	2.21	1.19	1.59	2.73	1.93	2.73	2.73
120000	1.25	3.46	3.24	3.79	2.90	2.14	1.73	2.97	1.69	1.77	2.28	1.93	1.39	1.93	1.85	1.54	2.28	2.47
122000	0.94	2.53	2.67	4.02	3.03	2.33	2.34	4.14	2.27	2.38	2.85	2.06	1.21	1.85	2.97	1.95	3.38	3.52
123000	1.82	12.58	10.18	5.44	3.84	3.14	2.62	4.58	2.47	2.46	3.23	2.69	1.83	2.41	3.15	2.47	3.09	3.36
124000	1.74	4.43	3.73	4.66	3.84	2.71	1.98	3.53	2.02	1.93	2.28	1.93	1.39	1.69	2.02	1.61	2.19	2.37
125000	0.81	4.96	5.77	4.86	3.84	3.11	2.39	3.40	1.83	1.97	2.43	1.88	1.32	1.72	2.15	1.80	2.52	2.62
126000	1.94	5.11	6.81	4.70	3.90	2.52	1.85	2.66	1.51	1.58	1.97	1.66	1.37	1.89	1.89	1.51	1.89	2.13
127000	1.20	7.73	6.18	3.88	2.56	2.20	1.87	3.17	1.79	1.79	2.29	1.95	1.34	1.71	2.29	1.95	2.38	2.47
128000	1.85	4.74	6.56	4.40	3.66	2.34	1.77	2.48	1.37	1.37	1.81	1.58	1.23	1.81	1.73	1.37	1.81	1.97
129000	1.45	4.62	5.50	4.12	3.54	2.08	1.77	2.86	1.58	1.73	2.05	1.66	1.30	1.66	1.89	1.44	1.97	2.13
130000	4.28	5.97	8.37	5.61	3.97	2.89	2.39	3.40	1.72	1.80	2.24	1.88	1.18	1.72	3.05	1.88	2.52	2.62
131000	2.26	4.78	6.23	5.41	3.97	3.34	2.49	3.91	2.06	2.06	2.62	2.06	1.18	1.56	2.15	1.63	2.33	2.52
132000	1.11	2.78	2.80	4.19	3.30	2.44	2.23	4.14	2.38	2.27	2.85	2.06	2.49	2.16	5.07	2.49	3.82	3.98
133000	1.54	4.89	5.70	4.62	3.50	2.50	2.22	3.33	1.73	1.90	2.26	1.81	1.18	1.65	2.76	1.73	2.45	2.66
134000	2.13	4.68	6.55	4.43	3.77	3.18	2.00	2.79	1.70	1.62	1.78	1.62	1.39	1.78	1.87	1.47	1.87	2.13
135000	1.23	4.88	4.43	3.66	2.92	2.10	1.71	2.60	1.52	1.67	2.07	1.82	1.37	1.82	1.67	1.52	2.07	2.32
136000	1.38	5.05	5.07	3.79	3.03	2.19	1.71	2.60	1.37	1.52	1.98	1.67	1.23	1.67	1.67	1.44	1.98	2.24

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 1

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
138000	1.23	4.72	4.28	3.79	2.82	2.02	1.71	2.60	1.52	1.59	2.07	1.82	1.37	1.82	1.67	1.52	2.07	2.32
140000	1.98	12.86	10.18	6.55	4.71	3.61	2.63	4.03	2.57	2.57	3.42	3.27	2.18	2.71	2.71	2.85	3.42	3.87
141000	1.39	8.70	6.86	4.67	3.32	2.64	2.02	2.76	1.88	1.87	2.59	2.58	1.71	2.05	2.50	2.22	2.56	2.81
142000	1.72	5.74	6.20	5.06	3.77	2.68	2.50	3.60	1.68	1.84	2.26	1.84	1.17	1.53	2.17	1.76	2.26	2.35
147000	1.77	11.08	7.74	5.63	4.52	3.17	2.43	3.60	2.21	2.21	3.11	2.95	1.93	2.21	2.50	2.35	2.80	2.95
149000	1.37	5.29	5.14	3.98	3.09	2.34	1.77	2.66	1.51	1.51	2.05	1.73	1.30	1.73	1.73	1.51	2.05	2.30
150000	1.12	6.14	5.29	3.72	2.59	2.03	1.53	2.26	1.33	1.49	1.90	1.73	1.26	1.49	1.65	1.57	1.90	2.08
151000	1.08	6.72	5.25	3.42	2.43	1.85	1.41	1.98	1.30	1.37	1.82	1.82	1.23	1.44	1.52	1.59	1.90	2.07
152000	1.38	5.20	5.22	3.78	3.31	2.33	1.88	2.69	1.42	1.49	2.01	1.74	1.26	1.66	1.74	1.49	2.01	2.38
153000	1.07	4.86	5.08	4.08	3.29	2.19	2.01	2.99	1.43	1.51	1.86	1.43	0.97	1.27	1.77	1.35	1.95	1.95
154000	1.55	4.05	4.84	3.72	3.07	2.39	1.72	2.63	1.68	1.68	1.92	1.76	1.38	1.76	1.76	1.45	2.00	2.26
155000	1.68	5.09	6.00	3.91	3.19	1.77	1.50	1.82	1.27	1.27	1.61	1.61	1.34	1.82	1.47	1.27	1.54	1.75
156000	1.30	2.39	2.41	3.65	2.62	2.54	2.15	4.19	2.19	2.01	2.38	1.92	1.58	2.19	2.38	1.83	2.48	2.59
157000	1.47	4.64	5.63	4.23	3.56	2.43	2.06	2.91	1.66	1.74	2.10	1.74	1.26	1.58	1.83	1.49	2.10	2.29
158000	3.54	5.14	7.64	5.03	3.70	2.78	2.39	3.16	1.72	1.80	2.15	1.88	1.32	1.80	2.33	1.72	2.33	2.43
159000	1.78	3.45	3.87	4.21	3.21	2.57	1.93	3.28	2.06	1.88	2.33	2.06	1.48	1.88	2.06	1.56	2.15	2.33
160000	1.71	4.07	4.91	4.30	3.50	2.71	2.04	2.87	1.73	1.57	1.99	1.65	1.26	1.73	1.65	1.26	1.73	1.99
161000	2.25	4.71	6.31	5.13	3.98	3.16	2.25	3.75	1.80	1.90	2.29	1.90	1.04	1.45	1.99	1.45	1.99	2.09
162000	1.41	4.16	4.70	3.64	2.80	2.19	1.48	2.34	1.43	1.43	1.77	1.60	1.12	1.51	1.51	1.19	1.68	1.95
163000	1.68	3.65	5.08	3.78	3.04	2.29	1.65	2.65	1.43	1.60	1.77	1.51	1.19	1.68	1.60	1.19	1.68	1.95
164000	2.12	5.61	7.18	5.27	3.70	2.33	1.97	2.80	1.26	1.34	1.66	1.49	1.04	1.42	1.74	1.34	1.66	1.83
165000	1.76	5.54	6.02	5.01	3.62	2.68	2.37	3.43	1.59	1.76	2.21	1.35	1.19	1.67	1.93	1.59	2.03	2.21
166000	1.57	4.75	5.78	4.31	3.62	2.36	2.08	2.95	1.50	1.67	2.03	1.67	1.19	1.50	1.76	1.42	1.93	2.12
167000	1.69	5.34	5.77	4.69	3.45	2.47	2.20	3.28	1.63	1.72	2.06	1.80	1.18	1.56	1.97	1.56	1.97	2.06
168000	1.45	3.78	4.40	3.72	2.91	2.31	1.69	2.66	1.57	1.57	1.90	1.73	1.26	1.65	1.73	1.33	1.90	2.08
169000	1.37	4.54	5.29	4.14	3.50	2.31	1.95	2.87	1.57	1.65	1.99	1.65	1.18	1.49	1.99	1.49	1.99	2.17
170000	1.35	3.86	5.13	4.42	3.83	2.91	2.58	4.05	2.29	2.40	2.96	2.19	1.20	1.62	2.61	1.71	2.61	2.84
171000	1.21	4.15	4.02	4.07	3.18	2.64	2.65	3.63	1.74	1.92	2.48	2.01	1.26	1.74	2.01	1.58	2.29	2.48
172000	1.76	4.24	6.02	4.31	4.05	2.79	2.37	3.43	1.85	1.93	2.31	1.34	1.19	1.67	2.21	1.50	2.12	2.41
173000	3.00	6.19	7.65	6.57	5.61	4.42	3.38	5.59	3.08	3.22	3.63	3.06	2.40	3.46	4.02	3.00	3.83	4.12
174000	0.99	3.09	3.24	3.71	2.97	2.11	2.13	3.29	1.88	1.97	2.37	1.88	1.28	1.88	2.07	1.61	2.58	2.80
175000	1.31	4.57	4.42	4.31	3.49	2.90	2.69	3.98	1.85	2.03	2.73	2.12	1.42	1.85	2.03	1.59	2.41	2.62
176000	0.94	3.47	3.80	4.02	3.30	2.56	2.57	3.98	2.38	2.49	2.97	2.16	1.13	1.66	2.27	1.66	2.73	2.85
177000	0.94	3.44	3.30	3.17	2.53	2.19	2.08	3.05	1.46	1.56	1.99	1.67	1.00	1.38	1.81	1.41	2.05	2.16
178000	2.63	4.67	7.36	4.93	4.29	3.06	2.40	3.90	1.95	2.05	2.34	1.77	1.19	1.68	2.14	1.51	2.05	2.34

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 1

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
179000	1.28	4.54	5.10	4.00	3.26	2.21	1.61	2.76	1.49	1.49	1.90	1.65	1.18	1.57	1.65	1.33	1.73	1.90
180000	0.85	2.45	2.47	3.94	2.95	2.25	2.15	3.74	2.19	2.41	2.77	1.98	1.22	1.77	2.19	1.77	2.89	3.16
181000	0.81	6.19	4.58	3.29	2.49	2.22	1.97	2.78	1.37	1.59	2.07	1.83	1.17	1.46	1.47	1.33	1.87	2.03
182000	1.97	4.29	4.80	3.92	3.21	3.00	2.29	3.40	2.06	1.88	2.06	1.80	1.40	1.88	2.06	1.56	1.97	2.24
183000	0.85	3.08	3.08	4.26	3.52	2.70	2.51	4.28	3.00	2.91	3.44	1.79	1.43	2.04	2.85	2.07	3.28	3.39
184000	1.57	4.75	5.70	4.50	3.58	2.51	2.34	3.30	1.85	1.93	2.37	1.85	1.31	1.77	2.10	1.77	2.37	2.56
185000	1.32	4.79	4.79	5.82	4.66	3.74	3.75	5.89	3.79	3.81	4.43	2.97	1.47	1.93	2.66	2.13	4.10	4.12
186000	1.79	4.56	5.83	4.33	3.36	2.19	1.79	2.79	1.44	1.67	2.07	1.67	1.30	1.74	1.82	1.44	1.90	2.15
187000	0.58	2.29	2.29	3.30	2.86	2.18	2.19	3.65	2.34	2.34	2.76	1.98	1.08	1.53	2.15	1.69	2.59	2.67
188000	1.14	3.52	3.36	3.21	2.46	1.78	1.52	2.46	1.39	1.27	1.65	1.39	1.02	1.27	1.91	1.39	1.78	1.78
189000	1.62	4.12	4.14	3.92	2.62	2.19	1.55	2.69	1.52	1.59	1.98	1.82	1.16	1.67	1.59	1.30	1.82	1.98
190000	2.71	4.27	6.13	4.66	4.25	3.73	2.43	5.12	2.37	1.77	2.56	1.69	1.24	1.77	2.19	1.54	1.77	2.56
191000	1.50	3.96	4.83	3.96	3.31	2.29	1.50	2.43	1.37	1.37	1.89	1.50	1.01	1.50	1.89	1.25	1.63	1.75
192000	1.19	4.20	4.37	3.42	2.84	2.04	1.42	2.17	1.42	1.54	1.79	1.66	1.31	1.79	1.91	1.42	1.91	2.17
193000	1.47	9.14	6.71	4.64	3.25	2.56	2.04	2.68	1.79	1.90	2.66	2.52	1.76	2.12	2.23	2.08	2.45	2.71
194000	1.30	4.88	4.74	3.66	2.72	2.10	1.71	2.51	1.44	1.52	1.98	1.74	1.30	1.67	1.74	1.52	1.98	2.15
195000	1.72	4.98	5.98	4.41	3.41	2.39	2.13	3.14	1.68	1.76	2.09	1.84	1.24	1.68	2.44	1.68	2.17	2.35
196000	1.39	5.35	5.56	4.41	3.41	2.39	2.31	3.36	1.84	1.84	2.17	1.84	1.31	1.68	2.63	1.84	2.35	2.44
197000	1.16	4.49	4.07	3.60	2.75	2.03	1.80	2.73	1.53	1.76	2.09	1.76	1.31	1.76	1.92	1.60	2.26	2.44
198000	0.97	7.71	5.27	3.36	2.18	1.78	1.51	2.43	1.36	1.35	1.72	1.58	0.94	1.16	1.49	1.20	1.54	1.66
199000	1.16	7.61	6.13	3.59	2.51	1.54	1.03	1.58	0.49	0.62	1.02	0.92	0.25	0.31	0.51	0.35	0.90	1.04

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 2

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
200000	1.09	5.54	4.07	3.48	2.37	2.03	1.80	2.73	1.53	1.68	2.17	1.84	1.24	1.53	1.84	1.60	2.00	2.26
201000	1.37	9.64	6.67	4.28	2.99	2.27	1.73	2.40	1.47	1.59	2.25	2.25	1.33	1.58	1.82	1.69	2.21	2.34
202000	1.59	5.61	5.84	4.93	3.52	2.64	2.46	3.59	1.70	1.87	2.21	1.87	1.17	1.47	2.21	1.70	2.21	2.31
203000	1.61	9.63	6.89	4.44	3.27	2.53	1.84	2.66	1.69	1.69	2.50	2.35	1.41	1.79	2.03	1.88	2.27	2.55
204000	1.36	4.84	5.03	3.67	2.75	1.98	1.61	2.19	1.36	1.50	1.80	1.72	1.29	1.72	1.72	1.43	1.87	2.03
205000	1.23	8.99	6.25	4.75	3.81	2.97	2.81	4.36	2.65	2.65	3.46	2.81	1.77	2.35	2.97	2.50	3.81	4.17
206000	1.70	3.98	5.07	3.92	2.92	2.36	2.20	2.99	1.74	1.74	1.98	1.67	1.30	1.90	2.07	1.59	1.98	2.24
207000	1.01	4.26	3.74	3.31	2.53	1.93	1.63	2.51	1.44	1.59	1.98	1.74	1.23	1.67	1.82	1.52	2.07	2.24
208000	2.46	5.93	7.14	4.76	4.10	2.97	2.24	3.56	1.57	1.50	2.19	1.72	1.16	1.57	2.03	1.57	1.72	1.95
209000	1.00	4.32	3.55	3.26	2.50	1.84	1.62	2.57	1.44	1.66	2.05	1.73	1.30	1.73	1.73	1.58	2.05	2.21
210000	1.27	5.07	4.93	3.61	2.81	1.88	1.53	2.17	1.42	1.49	1.78	1.71	1.35	1.71	1.71	1.49	1.86	2.09
211000	1.01	4.56	3.87	3.19	2.34	1.85	1.55	2.32	1.52	1.59	1.90	1.82	1.30	1.67	1.82	1.67	2.15	2.24
212000	1.34	4.75	5.09	3.73	2.91	1.96	1.60	2.17	1.42	1.49	1.78	1.71	1.35	1.78	1.63	1.49	1.86	2.09
213000	0.97	6.26	4.75	3.14	2.21	1.64	1.24	1.78	1.11	1.24	1.65	1.65	0.99	1.38	1.66	1.53	1.81	1.95

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 3

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
301000	2.30	4.13	3.48	4.66	4.11	4.89	3.49	4.94	1.69	1.93	1.93	1.69	1.39	1.93	1.85	1.54	2.02	2.19
302000	1.49	4.92	3.01	3.92	3.00	4.89	2.62	3.78	1.77	2.02	1.69	1.77	1.39	1.77	1.61	1.54	1.69	1.77
303000	2.93	4.75	4.30	5.36	4.11	3.60	2.72	3.53	1.77	1.77	1.69	1.69	1.31	1.69	1.69	1.46	1.93	1.93
304000	2.30	3.58	3.61	3.92	3.11	3.48	2.34	3.18	1.85	2.02	1.93	1.93	1.69	2.02	1.85	1.54	2.10	2.28
305000	3.18	4.26	3.87	4.95	3.71	4.40	2.56	3.54	1.52	2.07	1.44	1.67	1.37	1.74	1.74	1.44	1.98	2.07
306000	2.20	4.58	4.01	4.20	3.00	3.48	2.24	2.97	1.39	1.77	1.39	1.61	1.24	1.61	1.46	1.31	1.77	1.85
307000	2.30	4.27	3.61	4.66	3.71	4.42	3.26	4.62	2.10	2.28	1.93	1.85	1.46	1.85	1.77	1.61	1.93	1.93
308000	2.43	3.90	2.91	4.67	3.43	3.57	2.14	3.18	1.71	2.17	1.56	1.78	1.49	1.86	1.86	1.71	2.01	2.09
309000	2.56	4.24	4.13	4.46	3.37	3.62	2.24	3.12	1.57	1.87	1.57	1.65	1.36	1.72	1.65	1.43	1.95	2.03
310000	1.88	4.08	3.46	3.72	2.75	5.68	2.12	3.04	1.43	1.80	1.55	1.68	1.55	1.80	1.68	1.68	2.60	2.60

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 4

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
401000	1.35	4.96	3.73	4.52	3.09	3.59	2.59	4.33	2.15	2.15	2.24	1.88	1.40	1.63	1.72	1.48	1.80	2.06
402000	1.18	5.61	3.67	4.13	2.62	3.79	2.36	3.84	1.95	1.87	2.13	1.87	1.32	1.62	1.62	1.47	1.70	1.87
403000	1.50	5.03	3.80	4.93	3.39	4.35	4.37	5.23	2.13	2.13	2.40	1.87	1.47	1.78	2.04	1.62	2.13	2.50
404000	1.69	4.14	3.34	4.07	2.76	2.89	2.02	3.40	1.97	1.97	2.06	1.97	1.56	1.72	1.80	1.48	2.06	2.15
405000	3.06	5.05	4.58	6.32	4.38	4.55	3.39	5.80	2.79	2.79	2.60	2.15	1.44	1.74	2.15	1.74	2.24	2.32
406000	3.75	4.34	4.36	7.58	5.29	6.81	4.81	8.02	3.98	3.85	3.72	3.03	1.45	2.00	2.73	1.84	2.26	2.35
407000	1.61	5.06	3.82	4.64	3.37	3.41	2.40	3.84	1.93	1.93	1.93	1.80	1.42	1.80	1.93	1.80	2.76	2.76
408000	3.75	5.03	4.08	5.48	3.27	3.29	2.76	3.98	1.87	1.87	2.04	1.70	1.32	1.55	1.87	1.62	2.04	2.21
409000	2.13	4.68	4.23	5.89	4.04	4.06	3.08	5.81	3.12	2.50	2.90	2.04	1.17	1.55	2.04	1.47	1.78	1.87
410000	1.67	5.21	3.94	4.76	3.52	3.29	2.46	3.84	1.87	1.87	2.04	1.78	1.32	1.55	1.78	1.55	1.95	2.04
411000	3.36	4.05	3.93	7.28	4.78	6.81	4.97	8.75	4.25	3.85	3.98	2.53	1.38	2.00	2.73	1.84	2.17	2.17
412000	2.27	4.39	3.86	4.61	3.05	4.25	2.88	4.58	2.28	2.19	2.19	1.95	1.43	1.80	1.95	1.57	2.11	2.28
413000	2.46	4.81	4.21	7.58	4.47	5.69	4.81	8.37	5.01	3.48	4.25	2.73	1.31	1.92	2.63	1.76	2.09	2.09
414000	1.62	4.26	3.37	4.63	3.24	4.55	4.14	5.25	2.07	2.07	2.32	1.74	1.37	1.74	1.90	1.59	2.15	2.32
415000	3.03	4.45	4.80	10.39	7.13	9.37	7.78	12.94	6.92	5.95	6.17	3.28	1.04	2.15	3.52	1.80	1.63	2.15
416000	1.55	4.49	3.67	5.61	3.90	3.80	3.00	5.94	3.36	2.44	3.25	2.17	1.17	1.53	2.00	1.39	1.84	1.92
417000	1.90	4.22	3.80	6.46	3.90	4.68	4.38	7.75	3.98	3.33	3.98	2.45	1.11	1.73	2.45	1.65	2.26	2.36
418000	1.73	4.47	3.59	5.69	3.70	4.45	3.73	6.78	3.38	2.91	3.38	2.38	1.42	1.58	2.19	1.49	2.01	2.10
419000	1.98	4.34	3.93	6.73	4.04	5.13	4.35	8.37	4.54	3.25	3.98	2.44	1.17	1.76	2.35	1.60	2.73	2.83
420000	1.46	5.05	3.74	4.33	3.03	2.74	2.03	3.43	1.74	1.67	1.98	1.74	1.16	1.44	1.82	1.52	1.98	1.98
421000	2.46	4.48	3.20	4.35	3.00	3.73	2.45	3.40	1.67	2.04	1.66	1.73	1.45	1.73	1.72	1.50	1.85	2.00
422000	1.78	4.39	3.84	5.18	3.68	4.41	3.18	5.63	2.56	2.72	2.89	1.99	1.19	1.60	2.33	1.91	2.67	2.83
423000	1.76	3.97	3.22	4.29	3.07	3.06	2.25	4.12	2.11	2.11	2.77	1.98	1.13	1.60	2.21	1.82	2.32	2.32
424000	1.58	3.81	3.12	4.39	3.10	3.77	2.70	4.66	2.42	2.18	2.28	1.80	1.23	1.54	2.20	1.81	2.12	2.12
426000	4.02	4.73	4.78	8.40	5.58	7.72	5.05	9.56	4.21	4.04	4.04	2.63	1.54	2.20	3.07	2.20	2.92	2.77
427000	2.71	4.64	4.11	6.22	4.63	3.77	2.98	5.38	2.83	2.93	2.97	2.39	1.71	1.97	2.37	1.82	2.35	2.34
428000	2.71	5.20	4.46	7.38	4.28	5.19	4.10	7.62	4.27	3.28	3.92	2.67	1.46	1.97	2.65	1.69	2.21	2.34
429000	2.42	5.01	4.11	6.67	5.19	5.19	4.27	7.62	3.93	3.44	3.75	2.53	1.58	1.97	2.65	1.82	2.21	2.34
430000	2.46	5.10	4.36	7.53	4.18	5.09	4.01	7.79	4.18	3.19	3.83	2.59	1.37	2.02	2.72	1.74	2.14	2.28
431000	4.83	5.40	4.82	7.14	4.28	4.45	3.77	6.21	2.83	2.83	2.97	2.25	1.46	1.84	2.37	1.69	2.07	2.21
432000	2.42	5.81	4.83	6.67	4.46	4.82	3.78	6.22	3.14	2.84	3.29	2.55	2.41	2.13	2.54	1.98	2.67	2.67

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 5

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
501000	1.50	8.47	6.26	6.37	4.48	3.24	3.10	5.24	3.01	3.17	4.05	3.34	1.93	2.23	2.85	2.53	3.17	3.34
502000	1.35	8.65	6.63	5.06	3.76	2.93	2.95	4.68	2.70	2.86	3.54	2.86	1.64	1.93	2.70	2.54	3.03	3.20
503000	1.35	8.01	5.87	5.74	3.95	2.93	2.79	4.88	2.70	2.86	3.72	3.03	1.64	1.93	2.86	2.38	3.20	3.20
504000	1.20	10.94	8.18	3.91	2.83	2.11	2.14	3.13	1.79	2.07	2.82	2.36	1.26	1.39	1.79	1.79	2.07	2.22
505000	0.97	6.07	4.84	4.72	4.12	3.09	2.87	4.84	2.48	2.59	3.14	2.29	1.04	1.42	2.48	2.01	2.29	2.59
506000	1.20	9.86	7.04	3.81	2.54	1.97	1.86	2.85	1.93	1.79	2.53	2.38	1.10	1.37	1.65	1.65	1.79	2.08
507000	1.04	5.97	5.17	5.03	4.26	3.23	3.01	4.98	2.43	2.73	3.28	2.24	1.18	1.48	2.52	2.15	2.73	2.73
508000	2.18	13.04	9.22	7.35	4.99	4.02	4.29	5.98	4.01	3.78	5.27	4.49	2.21	2.70	3.33	3.12	3.33	3.66
509000	1.70	7.26	6.66	9.45	7.74	6.00	4.95	9.57	4.62	4.62	5.81	3.98	0.89	1.44	3.41	2.07	2.17	2.69
510000	1.63	14.60	10.72	5.63	4.15	3.01	3.04	4.29	2.80	2.80	3.77	3.60	1.79	2.07	2.65	2.65	3.11	3.27
511000	0.60	5.38	4.29	2.92	2.08	1.46	1.46	2.50	1.40	1.66	2.22	1.85	0.96	1.20	1.55	1.32	1.76	1.86
512000	0.66	4.53	3.93	3.66	2.90	2.23	2.13	3.57	1.96	2.07	2.52	1.90	0.92	1.38	2.53	1.85	2.51	2.63
513000	0.50	3.72	2.97	2.44	1.71	1.23	1.31	2.07	1.17	1.32	1.73	1.41	0.83	1.05	1.37	1.15	1.56	1.64
514000	1.52	13.58	10.97	7.11	5.39	3.92	4.15	6.79	3.64	4.43	5.53	4.43	1.93	2.57	4.03	3.27	4.43	4.64
515000	1.34	12.91	9.61	4.80	3.80	2.70	2.73	3.94	2.50	2.80	3.60	2.95	1.66	1.79	2.50	2.35	2.80	2.95
516000	1.25	8.40	6.96	5.47	3.90	2.99	2.88	5.18	3.04	3.29	4.29	3.55	1.61	1.97	2.92	2.37	3.29	3.41
517000	1.51	11.70	10.00	6.33	4.80	3.47	4.26	6.32	3.22	3.57	4.73	3.94	1.78	2.39	3.57	3.05	3.94	4.14
518000	0.99	6.72	5.71	4.24	3.29	2.39	2.40	4.20	2.34	2.55	3.36	2.76	1.35	1.60	2.55	2.05	2.65	2.76
519000	1.17	6.87	6.31	5.61	4.30	3.85	4.17	6.22	3.34	3.47	4.54	3.21	1.53	1.90	3.21	2.50	3.34	3.34
520000	1.26	9.80	8.06	4.28	3.16	2.26	2.46	3.59	2.13	2.21	3.23	2.79	1.17	1.47	2.04	1.87	2.31	2.40
521000	0.91	2.98	2.88	3.40	3.09	2.10	2.32	3.21	2.05	2.05	2.85	2.14	0.91	1.22	1.93	1.76	2.32	2.63
522000	0.46	2.59	2.32	2.32	2.90	1.61	1.61	2.27	1.48	1.49	2.20	1.58	0.72	0.99	1.56	1.36	1.98	2.07
523000	0.82	5.60	4.92	4.94	4.13	3.21	3.22	4.78	2.91	3.44	4.02	2.95	1.42	1.89	2.89	2.45	3.69	3.70
524000	1.26	6.09	4.90	5.62	4.07	3.27	3.48	4.97	3.12	3.13	3.94	3.55	2.10	2.66	3.26	2.93	3.95	3.96
525000	1.09	5.75	5.06	5.07	4.01	3.24	3.44	5.36	2.91	2.92	4.31	3.33	1.60	2.13	3.07	2.40	3.55	3.75
526000	0.80	5.96	6.46	3.71	2.58	1.92	2.05	3.18	1.78	1.89	2.32	1.99	1.10	1.29	1.99	1.58	1.99	2.10

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 6

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
601000	1.18	5.03	3.96	4.35	3.06	2.49	2.08	3.82	2.01	2.11	2.65	2.11	1.04	1.37	1.92	1.55	2.32	2.43
602000	1.54	4.22	3.53	4.45	3.38	2.71	2.32	4.27	2.26	2.36	2.76	1.99	1.18	1.57	2.17	1.65	2.45	2.66
603000	0.97	5.47	4.09	4.00	2.91	1.94	1.86	3.21	1.81	1.90	2.45	1.90	0.90	1.11	1.49	1.33	1.99	1.99
604000	1.62	4.07	3.40	4.79	3.63	3.04	2.52	4.74	2.45	2.55	2.98	2.26	1.33	1.73	2.45	1.90	2.76	2.87
605000	1.20	5.30	4.69	6.41	5.00	3.77	2.12	6.53	3.82	3.52	5.28	3.82	1.05	1.39	2.73	1.66	2.27	2.38
606000	0.79	5.60	4.47	3.98	2.72	2.12	1.90	3.40	1.86	1.93	2.60	2.01	0.97	1.29	1.71	1.42	2.09	2.26
607000	1.67	3.86	3.88	7.11	5.08	5.77	4.53	8.83	4.57	4.06	4.57	2.69	1.13	1.84	2.93	1.84	2.46	2.57
608000	1.82	4.59	3.41	8.54	5.35	5.15	4.37	9.18	5.66	4.23	5.90	3.89	0.97	1.58	3.16	1.58	2.19	2.41
609000	1.18	5.54	4.59	7.66	4.48	4.30	3.59	7.36	4.77	3.98	5.74	3.31	0.79	1.25	2.86	1.55	2.34	2.73
610000	0.98	5.25	4.94	4.95	3.56	2.95	2.59	4.97	2.78	2.97	3.70	2.37	1.30	1.64	2.49	1.88	2.79	2.88
611000	2.08	3.14	6.40	14.52	8.88	8.57	8.25	15.33	9.35	8.03	10.57	7.50	1.96	3.17	6.37	3.88	5.40	6.10
612000	1.33	5.18	4.99	4.42	3.21	2.90	2.30	4.07	2.17	2.17	2.76	2.18	1.24	1.64	2.49	1.93	2.66	2.81
613000	0.79	4.21	3.89	3.74	3.03	2.28	2.41	3.62	2.08	2.20	2.69	1.88	1.07	1.38	2.15	1.84	2.56	2.56
614000	1.53	4.90	3.88	4.98	3.40	3.56	2.92	5.10	2.84	2.61	3.21	2.40	1.20	1.53	2.40	1.71	2.19	2.40
615000	1.16	4.13	4.13	5.52	3.81	3.49	3.34	6.25	3.51	3.36	4.37	2.66	1.14	1.37	2.58	1.63	2.63	2.63
616000	2.21	6.39	5.75	8.68	5.57	6.42	5.58	10.30	5.41	4.84	6.04	4.16	1.80	2.50	4.23	2.70	3.49	3.65
617000	1.16	3.78	3.62	5.29	3.48	3.97	3.64	6.24	3.19	3.05	4.00	2.51	0.92	1.46	2.17	1.61	2.22	2.22
618000	1.35	3.77	3.43	7.65	5.09	4.70	3.96	8.52	5.11	3.46	5.32	2.98	1.02	1.55	3.18	1.58	2.01	2.15
619000	1.39	4.75	4.26	5.20	3.76	3.26	3.66	5.96	3.43	3.18	3.83	2.73	1.11	1.50	2.21	1.67	2.41	2.51
620000	0.92	3.34	3.22	4.35	3.46	2.96	3.22	4.47	2.77	2.77	3.26	2.21	1.12	1.55	2.43	1.82	2.88	3.13
621000	1.41	7.80	6.75	5.87	3.98	3.16	2.68	5.35	2.84	2.62	3.51	2.43	0.99	1.38	2.02	1.49	2.45	2.57
622000	0.83	4.03	3.39	3.39	2.82	2.17	2.05	3.26	1.83	1.95	2.32	1.62	0.99	1.31	1.99	1.55	2.27	2.27
623000	2.04	4.44	3.53	4.59	3.66	2.89	2.32	4.18	1.99	2.25	2.81	1.92	1.33	1.86	2.29	1.81	2.41	2.59
624000	1.74	4.10	3.36	4.29	3.19	2.69	2.06	3.73	1.91	1.91	2.38	2.07	1.21	1.64	2.25	1.66	2.27	2.28
625000	1.81	5.47	4.27	5.48	4.14	4.01	3.01	5.32	2.92	2.72	3.16	2.74	1.90	2.46	3.71	2.61	3.28	3.40
626000	1.14	4.80	3.82	4.19	3.10	2.45	2.14	3.81	2.13	2.13	2.60	2.13	1.26	1.82	2.75	2.26	2.90	3.07
627000	3.06	2.23	3.18	2.08	2.07	1.68	1.68	3.27	1.77	1.52	2.13	1.62	0.67	0.98	1.66	1.14	1.58	1.69
628000	1.12	4.41	3.59	4.24	2.98	2.42	2.15	3.76	2.15	2.02	2.85	2.16	1.16	1.41	2.05	1.67	2.20	2.34
629000	1.24	3.37	2.95	3.51	2.55	2.42	1.92	3.50	1.79	1.79	2.40	1.78	0.98	1.54	2.13	1.88	2.36	2.36
630000	1.32	3.85	3.01	3.85	2.88	2.49	2.00	3.56	2.00	1.88	2.36	1.76	1.09	1.30	1.98	1.63	2.09	2.21

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 7

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
701000	1.46	6.21	5.49	10.54	6.62	5.61	5.62	11.46	7.31	6.14	10.00	5.44	0.97	1.46	2.88	1.82	2.32	2.54
702000	0.55	16.42	8.64	3.42	1.97	1.53	1.20	1.34	1.09	1.22	1.57	1.95	1.13	1.21	1.37	1.66	1.76	1.84
703000	0.69	28.38	23.99	4.10	2.06	1.32	0.98	1.67	0.94	0.94	1.30	1.93	0.59	0.82	0.94	1.30	1.30	1.42
704000	0.53	4.61	4.16	2.50	1.41	0.78	0.66	1.18	0.76	0.90	1.18	1.18	1.11	1.97	1.32	1.18	2.43	2.06
705000	0.53	4.24	4.10	2.19	1.19	0.84	0.65	1.27	0.89	0.89	1.11	1.04	0.97	1.42	1.76	1.67	1.93	2.03
707000	0.67	4.49	4.21	2.70	1.53	0.91	0.99	1.31	0.90	1.03	1.10	1.31	1.38	1.68	1.38	1.38	2.53	2.17
708000	0.80	4.94	4.49	2.64	1.74	1.11	0.99	1.44	1.10	1.03	1.30	1.51	1.51	2.13	1.58	1.51	2.86	2.48
709000	1.49	6.27	5.25	5.26	3.88	2.95	2.55	4.46	2.28	2.56	3.19	2.68	1.71	2.14	2.53	2.27	2.96	3.07
710000	1.27	7.08	6.29	6.30	4.88	3.56	3.08	5.46	2.99	3.22	3.73	3.12	1.86	2.33	3.30	2.67	3.86	3.86
711000	1.62	1.27	1.18	2.39	2.35	2.39	1.46	2.21	1.28	1.66	1.28	1.40	1.53	2.07	2.35	1.93	3.57	3.25
712000	1.25	0.42	0.56	1.57	1.14	1.56	0.19	1.28	0.17	0.72	0.22	0.28	0.55	0.98	1.03	0.48	0.89	0.97
713000	1.74	5.67	4.61	4.06	1.95	2.81	2.07	2.76	1.17	1.69	1.61	1.85	1.31	1.54	1.39	1.39	1.69	1.77
714000	3.19	4.84	6.17	6.68	6.73	3.86	2.78	1.95	1.22	1.72	1.65	1.65	1.36	1.95	1.87	1.43	1.57	1.80
715000	1.67	4.35	2.48	4.04	1.46	2.75	0.99	3.94	0.59	1.43	1.45	1.22	0.64	0.96	1.00	0.96	1.31	1.48
716000	2.94	5.19	4.59	4.37	3.79	2.77	1.44	1.98	1.34	1.76	1.41	1.76	1.41	1.76	1.69	1.48	1.48	1.69
717000	1.26	4.85	3.67	3.72	2.52	2.26	1.67	2.79	1.32	1.70	1.87	1.62	1.32	1.62	1.55	1.47	1.95	2.04
718000	1.74	3.14	2.83	3.28	2.12	1.46	1.45	2.52	1.19	1.19	1.55	1.17	0.57	0.79	1.38	0.99	1.21	1.59
719000	3.29	4.75	4.61	9.94	6.72	9.50	7.02	13.07	6.31	5.48	6.08	3.30	1.31	2.28	2.86	2.02	1.93	2.56

TABLE AII-I. ABSORPTIVITIES FOR UNWEATHERED OILS. FILE 8

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
801000	0.26	3.64	3.27	2.24	1.58	1.28	0.86	1.99	1.41	1.11	1.33	1.33	1.18	1.57	1.81	1.41	1.99	2.36
802000	0.73	5.35	3.74	2.24	1.50	1.17	0.87	1.29	0.90	1.03	1.16	1.29	1.16	1.29	1.16	1.22	1.57	1.57
803000	0.60	4.45	3.01	1.97	1.35	0.91	0.75	1.09	0.90	1.03	1.03	1.29	1.35	1.56	1.16	1.29	2.01	1.86
804000	0.47	4.05	2.97	2.05	1.38	0.93	0.61	1.03	0.71	0.90	0.90	1.10	1.17	1.84	1.24	1.10	2.17	1.84
805000	1.25	3.98	3.21	2.56	1.74	1.75	1.13	1.60	1.29	1.53	1.09	1.17	1.25	1.57	2.27	1.85	3.01	3.36
806000	0.69	4.58	2.77	2.18	1.35	0.92	0.86	1.60	1.16	1.38	1.32	1.25	1.33	1.74	2.29	1.87	2.62	2.72
807000	1.36	5.77	4.23	3.32	2.20	1.69	1.31	2.40	1.32	1.79	1.88	1.72	1.81	2.34	2.18	2.47	5.32	4.97
808000	0.73	4.85	2.88	1.77	1.54	0.83	0.77	1.26	1.26	1.34	1.07	1.14	1.29	1.77	1.95	1.57	2.35	2.54
809000	0.77	6.45	4.51	2.48	1.89	1.20	1.05	1.64	1.65	1.84	1.67	1.51	1.79	2.39	2.64	2.35	3.23	3.42
810000	0.73	3.81	2.91	2.26	1.47	0.99	0.93	1.93	1.06	1.26	1.48	1.48	1.41	1.86	1.71	1.49	2.38	2.56
811000	0.49	3.69	2.66	1.69	1.02	0.79	0.57	0.87	0.64	0.79	0.87	0.87	0.87	1.03	1.03	0.96	1.28	1.28
812000	1.00	2.19	2.01	3.58	2.29	1.74	1.83	3.84	1.33	1.84	2.12	1.41	1.25	1.76	2.04	1.52	2.05	2.14
813000	0.87	2.09	1.99	3.15	2.49	2.00	1.54	4.16	1.81	1.63	2.10	1.63	1.29	1.73	1.91	1.64	2.11	2.21
814000	0.58	4.26	3.31	1.79	1.30	0.93	0.71	0.93	0.71	0.92	1.00	1.14	1.07	1.22	1.14	1.06	1.60	1.52
815000	1.09	2.65	2.35	4.17	2.81	2.05	2.35	5.15	1.77	2.05	2.65	1.77	1.49	2.35	2.81	2.05	2.81	2.97
816000	0.32	4.49	3.78	2.08	1.15	0.89	0.53	0.89	0.64	0.76	0.87	1.11	0.98	1.22	0.96	1.07	1.44	1.56
817000	0.78	6.12	5.10	2.60	1.77	1.26	1.01	1.51	1.13	1.38	1.50	1.50	1.37	1.62	1.36	1.48	2.01	2.00
818000	0.98	6.22	4.49	2.62	1.82	1.08	1.08	1.68	1.07	1.31	1.67	1.67	1.54	1.92	1.52	1.64	2.28	2.28
819000	1.04	3.26	2.80	4.44	2.65	2.37	3.27	6.71	2.09	2.66	3.12	2.38	2.10	3.77	2.53	2.83	3.78	3.95
820000	1.35	7.49	5.91	3.57	2.52	1.98	1.22	2.25	1.34	1.72	1.97	2.10	1.71	2.79	1.57	1.70	2.22	2.49
821000	1.65	3.21	2.90	5.11	3.05	3.21	2.75	5.30	2.18	2.75	3.21	2.32	2.05	2.46	2.75	2.18	3.05	3.21
822000	0.90	6.13	4.54	2.75	1.91	1.52	1.02	1.52	0.90	1.39	1.52	1.65	1.27	2.18	1.14	1.39	1.65	1.91
823000	1.41	2.79	2.49	4.43	2.93	2.49	2.20	4.61	1.92	2.34	2.77	2.05	1.78	2.19	2.32	1.90	2.60	2.75
824000	1.43	3.15	3.00	5.29	3.31	2.55	1.98	1.84	1.98	2.55	3.16	1.99	1.85	2.42	2.57	2.00	3.03	3.19
825000	0.77	5.40	4.47	2.28	2.56	1.00	0.76	1.00	0.99	1.11	0.99	1.35	1.48	1.47	1.22	1.22	1.98	1.93
826000	0.77	5.01	3.94	2.00	1.48	0.99	0.87	1.22	0.86	1.10	1.34	1.34	1.09	1.32	1.07	1.18	1.67	1.54
827000	0.82	2.42	2.28	3.36	2.72	2.28	2.28	5.17	1.72	1.99	2.42	1.86	1.72	2.28	3.03	2.28	2.88	3.03

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 11

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
152101	1.04	6.53	4.49	4.04	2.64	2.21	2.00	3.25	1.81	1.92	2.56	2.24	1.37	1.65	2.71	2.18	2.74	2.98
152103	0.89	5.45	3.62	3.26	2.22	1.76	1.67	2.70	1.40	1.48	2.00	1.81	1.05	1.36	2.14	1.76	2.20	2.39
152104	0.78	5.69	4.03	3.48	2.40	1.88	1.79	2.87	1.60	1.60	2.21	1.90	1.16	1.43	2.34	1.83	2.47	2.69
152105	1.05	6.45	4.56	4.10	2.90	2.12	2.02	3.29	1.92	1.92	2.57	2.24	1.36	1.74	2.71	2.27	2.85	3.09
152106	0.98	6.61	4.50	4.19	2.73	2.17	2.07	3.37	1.88	1.88	2.54	2.21	1.42	1.82	2.82	2.27	2.98	3.11
152202	0.81	5.56	3.75	3.22	2.39	1.77	1.57	2.52	1.59	1.50	2.11	1.91	1.16	1.54	2.72	2.19	3.01	3.13
152203	1.37	8.39	5.82	4.98	4.21	2.54	2.55	4.05	2.26	2.27	3.21	2.89	1.72	2.31	3.94	3.28	4.72	4.73
152204	0.82	5.67	3.96	3.40	2.42	1.78	1.68	2.66	1.60	1.60	2.23	1.91	1.24	1.73	2.96	2.51	3.38	3.52
152311	0.92	5.63	4.01	3.74	2.42	2.11	1.91	3.10	1.71	1.71	2.31	1.81	1.17	1.35	2.01	1.71	2.11	2.21
152312	0.83	5.18	3.43	3.19	2.09	1.62	1.53	2.51	1.45	1.45	2.01	1.64	1.03	1.20	1.94	1.48	1.96	2.16
152313	0.92	5.11	3.49	3.24	2.44	1.83	1.64	2.78	1.47	1.47	2.04	1.75	0.96	1.22	2.07	1.59	1.99	2.19
152321	0.93	5.21	3.68	3.29	2.25	1.85	1.75	2.81	1.48	1.48	2.59	1.76	0.96	1.22	1.88	1.59	1.99	2.09
152322	0.88	5.22	3.52	3.40	2.21	1.74	1.75	2.74	1.49	1.67	2.14	1.86	1.10	1.44	2.08	1.73	2.02	2.31
152323	0.85	5.48	3.63	3.26	2.25	1.76	1.77	2.70	1.51	1.51	2.09	1.80	1.10	1.37	2.14	1.68	2.29	2.40
152324	0.92	5.19	3.32	3.20	2.32	1.74	1.65	2.66	1.48	1.58	2.06	1.87	1.17	1.53	2.42	1.94	2.36	2.57
152325	0.85	5.48	3.77	3.26	2.26	1.77	1.68	2.60	1.61	1.61	2.10	1.91	1.11	1.48	2.47	1.99	2.52	2.64
152326	0.98	5.63	4.00	3.74	2.73	1.91	1.83	2.95	1.84	1.76	2.37	2.11	1.40	1.72	2.80	2.25	2.74	2.84
162101	0.92	4.31	3.11	3.35	2.43	1.91	1.63	2.76	1.63	1.63	2.12	1.92	1.27	1.64	2.23	1.83	2.45	2.55
162102	0.90	4.50	3.61	3.35	2.39	1.86	1.47	2.63	1.68	1.49	2.10	1.90	1.33	1.82	2.59	2.17	2.86	2.98
162201	0.67	3.06	2.49	2.39	1.70	1.33	1.16	1.79	1.08	1.08	1.43	1.34	1.00	1.34	1.90	1.81	2.41	2.41
162202	0.92	5.86	3.36	3.38	2.68	2.17	1.70	2.46	1.76	1.54	2.04	2.18	1.85	2.51	3.88	3.79	5.49	5.51
162203	0.75	5.59	4.77	3.58	2.77	2.01	1.67	2.47	1.41	1.27	2.03	1.89	1.59	2.60	3.98	4.09	5.97	6.00
162301	0.92	3.75	2.76	2.99	2.02	1.73	1.27	2.33	1.37	1.28	1.74	1.55	1.03	1.29	1.66	1.39	1.86	2.06
162302	1.07	4.62	4.18	3.64	2.59	1.99	1.53	2.72	1.72	1.64	2.21	1.93	1.31	1.49	2.06	1.71	2.20	2.41
162303	1.01	4.33	3.25	3.50	2.35	1.95	1.48	2.69	1.59	1.59	2.08	1.98	1.26	1.62	2.12	1.66	2.37	2.48
169101	0.48	3.60	2.95	2.84	2.16	1.56	1.28	2.39	1.38	1.38	1.78	1.40	0.87	1.23	2.23	1.64	2.27	2.27
169102	0.62	3.11	2.67	2.66	1.95	1.49	1.31	2.12	1.29	1.20	1.54	1.27	0.77	1.00	1.76	1.38	1.90	1.90
169103	0.67	4.54	3.39	3.62	2.72	2.03	1.94	3.03	1.84	1.84	2.29	1.91	1.15	1.55	2.87	2.05	2.94	2.94
169201	0.38	2.99	2.31	2.40	1.77	1.29	1.06	1.85	0.98	1.05	1.35	1.12	0.61	0.89	1.82	1.40	1.98	1.97
169203	0.71	3.95	3.09	2.87	2.55	1.96	1.87	2.55	1.69	1.60	1.96	1.78	1.34	1.96	3.82	3.32	4.95	5.11
169301	0.72	3.42	2.61	2.72	1.99	1.53	1.35	2.59	1.43	1.42	1.78	1.41	0.83	1.06	1.57	1.20	1.72	1.91
169302	0.82	5.40	4.27	4.07	3.28	2.38	2.05	3.47	2.05	2.06	2.56	1.90	1.28	1.59	2.93	2.08	2.95	2.95
169303	1.00	5.68	4.43	4.60	3.41	2.55	2.43	3.85	2.34	2.34	2.81	2.36	1.44	1.85	3.24	2.31	3.15	3.28
170201	0.48	2.79	2.33	2.98	2.78	1.81	1.65	2.96	1.64	1.96	2.39	1.18	0.96	1.31	2.44	1.75	2.50	2.59
170203	0.84	3.84	3.62	4.08	3.40	2.60	2.51	4.21	2.52	2.80	3.41	2.80	1.59	2.35	4.61	3.65	4.76	5.18

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 11

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
170301	0.46	2.85	2.51	3.10	2.41	1.89	1.70	3.24	1.80	2.01	2.43	1.82	0.92	1.18	2.25	1.57	2.28	2.50
170302	0.77	4.10	3.54	4.71	3.55	2.70	2.70	4.73	2.71	2.88	3.77	2.73	1.37	1.81	3.62	2.46	3.48	3.85
170303	0.91	4.66	4.14	5.24	4.17	3.12	2.99	5.28	3.16	3.16	4.23	3.05	1.64	2.10	4.16	2.77	4.08	4.41
170481	0.72	3.12	2.87	3.64	2.86	2.27	2.27	3.76	2.26	2.49	2.97	2.13	1.17	1.57	2.94	1.87	2.91	2.91
170482	0.75	3.52	3.19	4.25	3.22	2.60	2.31	4.30	2.64	2.65	3.47	2.54	1.30	2.01	3.92	2.67	3.68	3.86
170483	0.67	4.04	3.56	4.56	3.74	2.85	3.00	4.95	3.02	3.32	4.12	2.91	1.61	2.40	5.06	3.30	4.95	4.96
171101	0.59	2.93	2.49	2.60	1.88	1.51	1.60	2.60	1.42	1.42	1.88	1.42	0.90	1.15	1.88	1.42	1.98	2.18
171102	0.72	3.97	3.42	3.56	2.70	2.16	2.27	3.59	2.08	1.98	2.63	2.20	1.25	1.73	2.81	2.18	2.98	3.11
171103	0.93	5.16	4.07	4.60	3.94	2.53	2.54	4.30	2.57	2.33	3.26	2.37	1.49	2.18	3.81	2.74	4.22	4.56
171201	0.59	3.17	2.60	2.82	2.18	1.70	1.60	2.72	1.61	1.52	2.09	1.61	0.92	1.26	2.30	1.71	2.41	2.52
171202	0.46	5.05	4.00	4.17	3.28	2.50	2.51	4.07	2.55	2.32	3.09	2.47	1.60	2.29	4.09	3.00	4.68	5.05
171203	0.83	5.15	4.06	4.24	3.31	2.51	2.52	4.11	2.30	2.31	3.24	2.46	1.56	2.26	4.08	3.08	4.66	4.85
171301	0.78	4.03	2.97	3.61	2.52	2.09	2.31	3.37	1.80	1.81	2.54	1.82	1.09	1.54	2.47	1.76	2.49	2.61
171302	0.70	3.83	2.82	3.31	2.50	1.98	2.09	3.21	1.81	1.81	2.33	1.83	1.03	1.39	2.49	1.71	2.43	2.65
171303	0.82	4.36	3.63	3.92	2.88	2.31	2.32	3.81	2.13	2.03	2.82	2.26	1.39	1.79	3.02	2.15	2.97	3.22
172101	0.74	4.21	3.37	4.07	3.02	2.28	2.09	3.68	2.22	2.13	2.75	2.16	1.32	1.83	3.07	2.27	3.38	3.51
172102	0.98	5.61	4.32	5.42	4.19	3.04	2.92	4.73	2.83	2.71	3.53	3.00	1.76	2.45	4.40	3.15	4.34	4.68
172103	0.79	3.90	2.87	3.77	2.66	2.12	1.92	3.28	1.84	1.95	2.48	1.97	1.32	1.80	3.00	2.25	2.94	3.18
172201	1.06	5.24	4.39	5.06	3.83	2.87	2.67	4.60	2.70	2.70	3.51	2.63	1.58	2.19	3.99	2.95	4.21	4.51
172202	1.21	5.41	4.73	5.24	4.43	2.97	2.85	4.61	3.88	4.17	3.63	2.45	1.57	2.48	4.70	3.33	4.75	4.76
172203	0.60	3.13	2.60	2.91	2.12	1.60	1.60	2.50	1.51	1.43	1.94	1.51	1.03	1.50	2.90	2.11	3.11	3.11
172311	0.95	4.12	3.31	3.99	2.85	2.20	2.21	3.88	2.23	2.13	2.79	2.15	1.32	1.60	2.75	1.94	2.70	2.93
172312	0.96	4.04	3.24	4.05	2.89	2.33	2.13	3.67	2.25	2.15	2.82	2.17	1.32	1.70	2.88	2.15	2.94	3.06
172313	0.78	4.31	3.47	4.17	3.62	2.38	2.29	3.78	2.31	2.22	2.84	2.33	1.40	1.74	3.13	2.23	3.08	3.43
172321	0.87	4.89	3.60	4.55	3.34	2.46	2.58	3.95	2.37	2.37	3.00	2.64	1.45	2.10	3.48	2.61	3.54	3.83
172322	0.72	3.95	2.92	3.68	2.72	2.02	1.85	3.44	1.95	1.96	2.55	1.98	1.09	1.57	2.93	2.05	2.76	2.98
172331	1.07	4.86	3.80	4.69	3.35	2.90	2.61	4.75	2.51	2.38	2.98	2.27	1.26	1.79	3.25	2.28	3.20	3.36
172332	1.04	4.89	4.01	4.54	3.40	2.81	2.53	4.41	2.56	2.43	3.17	2.46	1.57	1.98	3.74	2.73	3.67	3.84
172333	0.84	4.96	4.09	4.74	3.51	2.78	2.44	4.35	2.46	2.47	3.19	2.49	1.54	2.02	3.83	2.75	3.70	3.90
174101	0.68	3.49	2.96	3.81	2.75	2.09	2.21	3.58	2.25	2.26	2.85	2.30	1.47	2.06	3.93	3.04	4.52	4.70
174102	0.49	3.45	2.89	3.63	2.81	1.91	1.82	3.55	2.08	2.09	2.68	2.14	1.39	2.10	3.93	3.02	4.56	4.75
174103	0.54	2.61	2.23	2.82	1.95	1.61	1.61	2.62	1.61	1.61	2.05	1.70	1.06	1.70	3.15	2.43	3.61	3.61
174201	0.69	3.32	2.96	3.74	2.88	1.97	1.89	3.53	2.02	2.12	2.75	2.16	1.18	1.86	3.72	2.51	4.24	4.25
174202	0.57	2.18	1.89	2.28	1.80	1.28	1.28	2.18	1.28	1.28	1.71	1.19	0.87	1.36	2.80	1.99	3.14	3.26
174203	0.56	4.46	3.73	4.49	3.57	2.73	2.54	4.36	2.82	2.64	3.53	2.92	1.98	3.45	6.97	5.31	9.79	10.26

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 11

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
174311	0.78	3.73	3.19	4.21	3.10	2.42	2.32	3.95	2.57	2.47	3.18	2.40	1.49	2.05	3.28	2.53	3.90	4.20
174312	0.59	3.22	2.72	3.64	2.63	2.08	1.98	3.42	2.23	2.13	2.59	2.05	1.28	1.79	3.06	2.29	3.53	3.81
174313	0.66	3.47	2.95	3.78	2.74	2.10	1.92	3.69	2.36	2.26	2.83	2.40	1.48	2.15	3.73	2.77	4.12	4.44
174321	0.68	3.31	2.79	3.46	2.68	1.89	1.79	3.22	2.02	1.92	2.49	2.05	1.15	1.66	2.56	2.13	3.24	3.38
174322	0.68	3.87	3.27	4.22	3.17	2.32	2.11	3.94	2.47	2.26	3.11	2.29	1.52	2.13	3.78	2.88	4.35	4.70
177101	0.87	4.42	3.42	3.98	2.97	2.44	2.65	3.88	2.18	2.09	2.92	2.41	1.37	1.81	3.01	2.32	3.31	3.56
177102	1.16	6.22	4.84	5.49	4.33	3.27	3.41	5.34	3.06	2.94	3.93	3.24	2.01	2.57	4.39	3.53	4.67	5.04
177103	0.77	4.52	3.59	4.04	2.97	2.31	2.42	3.79	2.15	2.06	2.92	2.18	1.31	1.85	3.27	2.51	3.49	3.75
177201	1.12	5.25	4.43	4.74	3.50	2.84	3.05	4.61	2.18	2.56	3.41	2.67	1.33	1.80	3.12	2.34	3.38	3.61
177202	0.54	2.53	2.17	2.25	1.74	1.34	1.49	2.14	1.32	1.32	1.69	1.22	0.71	1.12	1.88	1.45	2.00	2.17
177203	0.61	3.97	2.97	3.25	2.49	1.82	1.82	3.02	1.53	1.75	2.31	1.88	1.18	1.70	3.00	2.30	3.33	3.34
177311	0.80	4.41	3.41	4.11	2.92	2.46	2.69	3.99	2.15	2.15	2.83	2.27	1.20	1.68	2.53	2.01	2.79	2.91
177312	0.79	4.27	3.31	3.71	2.74	2.31	2.42	3.75	1.93	1.83	2.67	2.25	1.14	1.60	2.64	1.94	2.70	2.93
177313	0.80	4.50	3.77	4.06	3.02	2.45	2.56	3.81	2.26	2.16	3.07	2.50	1.33	1.91	3.02	2.38	3.08	3.33
177321	0.65	4.03	3.18	3.46	2.69	2.01	2.01	3.20	1.92	1.81	2.48	2.14	1.24	1.84	2.99	2.30	3.02	3.28
177322	0.98	4.62	3.33	4.15	2.98	2.55	2.77	4.17	2.17	2.17	2.90	2.28	1.26	1.67	2.72	2.05	2.86	2.97
177331	0.83	3.77	3.15	3.52	2.49	2.19	2.30	3.42	1.83	1.83	2.43	1.94	1.07	1.42	2.18	1.64	2.33	2.43
177332	1.04	5.07	3.84	4.36	3.23	2.65	2.80	4.23	2.14	2.42	3.15	2.44	1.42	1.95	3.55	2.70	3.48	3.49
177333	0.93	4.71	3.69	3.86	2.95	2.39	2.40	3.76	2.03	2.04	2.89	2.35	1.22	1.87	3.46	2.63	3.40	3.56
179101	0.55	3.29	2.43	2.42	1.52	1.00	1.07	1.74	0.86	0.86	1.20	0.92	0.52	0.71	1.18	0.96	1.39	1.46
179102	0.61	4.20	2.77	3.09	1.89	1.36	1.36	2.25	1.27	1.27	1.69	1.51	0.94	1.25	1.75	1.56	1.99	2.08
179103	0.91	6.10	4.86	4.66	3.26	2.48	2.05	3.56	2.17	2.16	2.90	2.58	1.72	2.12	3.15	2.66	3.42	3.58
179201	0.88	5.79	4.11	4.27	2.83	1.99	1.72	3.27	1.97	1.97	2.52	2.23	1.56	1.94	2.77	2.33	3.04	3.19
179202	0.55	3.48	2.39	2.20	1.69	1.08	0.86	1.60	1.06	0.92	1.28	1.20	1.04	1.56	2.22	2.11	2.84	2.94
179203	0.74	4.82	3.08	3.08	2.10	1.66	1.66	2.28	1.57	1.41	1.91	1.91	1.49	2.09	3.07	2.96	3.87	3.99
179301	0.82	5.00	4.08	3.81	2.49	1.88	1.60	3.17	1.78	1.78	2.38	1.88	1.24	1.42	1.98	1.60	1.98	2.18
179302	0.98	5.45	3.52	4.24	2.84	2.07	1.78	3.51	2.07	1.92	2.67	2.06	1.35	1.77	2.35	1.76	2.49	2.65
179303	0.87	5.32	3.75	4.03	2.52	1.99	1.60	2.64	1.80	1.71	2.43	1.92	1.26	1.54	2.25	1.76	2.28	2.39
181101	0.65	5.68	3.92	3.09	2.22	1.57	1.42	2.70	1.44	1.67	2.25	2.00	1.25	1.63	2.13	1.90	2.26	2.53
181102	0.92	6.12	4.56	2.75	1.83	1.21	1.13	2.35	1.15	1.32	1.88	1.61	1.02	1.37	1.75	1.59	1.99	2.19
181103	0.77	7.38	5.23	3.80	2.63	1.88	1.80	3.32	1.91	2.00	2.79	2.59	1.61	2.05	2.75	2.57	3.13	3.37
181201	0.74	7.57	5.30	3.93	2.72	1.92	2.00	3.51	1.86	1.87	2.66	2.34	1.34	1.76	2.37	2.00	2.66	2.84
181202	0.36	3.99	2.67	1.93	1.34	0.96	1.03	1.73	0.94	1.01	1.38	1.22	0.76	1.11	1.40	1.30	1.68	1.68
181203	0.70	7.09	5.51	3.17	2.23	1.46	1.60	2.58	1.48	1.48	2.30	2.17	1.24	1.77	2.48	2.21	2.81	3.12
181311	0.82	6.37	4.39	3.36	2.35	1.85	1.69	2.94	1.78	1.70	2.47	2.12	1.28	1.81	2.15	2.00	2.45	2.73

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 11

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
181312	0.81	5.50	3.70	2.98	2.05	1.50	1.41	2.67	1.51	1.52	2.07	1.80	1.19	1.54	1.92	1.75	2.24	2.45
181313	0.66	5.83	4.14	3.04	1.99	1.59	1.44	2.74	1.60	1.53	2.19	1.94	1.18	1.64	2.06	1.83	2.36	2.46
181321	0.91	6.30	4.23	3.30	2.29	1.70	1.80	2.84	1.62	1.62	2.41	2.10	1.27	1.72	2.11	1.92	2.44	2.65
181322	0.58	5.61	3.85	3.01	2.05	1.63	1.40	2.70	1.56	1.48	2.14	1.80	1.12	1.48	1.89	1.72	2.06	2.24
181331	0.85	5.68	3.86	3.07	2.31	1.75	1.52	2.77	1.53	1.60	2.15	1.83	1.19	1.61	1.92	1.69	2.01	2.17
181332	0.88	6.16	4.31	3.22	2.13	1.63	1.52	2.83	1.54	1.67	2.19	1.94	1.12	1.61	2.27	2.04	2.47	2.61
181333	0.90	7.06	4.91	3.73	2.86	1.91	1.77	3.21	1.78	1.78	2.72	2.25	1.37	1.67	2.44	2.30	2.80	2.80
185101	0.63	3.22	3.06	4.49	3.59	2.62	2.62	4.54	2.81	2.66	3.49	2.53	1.41	2.13	3.75	2.80	4.18	4.37
185102	0.25	1.70	1.56	2.29	2.00	1.30	1.30	2.31	1.18	1.45	1.74	1.19	0.81	1.21	2.68	1.93	3.20	3.20
185103	0.33	2.85	2.75	3.89	3.40	2.35	2.35	3.89	2.54	2.64	3.18	1.97	1.54	2.35	4.41	3.29	4.84	5.15
185201	0.61	2.97	2.85	4.15	3.27	2.39	2.39	4.19	2.66	2.67	3.20	2.00	1.39	2.15	3.70	2.80	4.07	4.24
185202	0.76	4.07	3.58	4.81	3.61	2.89	2.90	4.67	2.80	2.94	3.69	2.98	1.65	2.25	4.65	3.25	6.91	7.47
185203	0.49	2.77	2.64	3.84	3.24	2.42	2.43	3.91	2.35	2.48	3.19	2.79	1.49	2.09	4.44	3.37	5.50	5.51
185301	0.54	2.32	2.22	3.15	2.55	1.91	1.91	3.16	2.02	2.03	2.46	1.93	1.00	1.36	2.27	1.76	2.73	2.85
185302	0.52	2.77	2.77	3.86	2.96	2.45	2.62	3.88	2.47	2.47	2.99	2.16	1.13	1.57	3.03	2.21	3.24	3.42
185303	0.79	3.73	3.58	5.04	4.11	3.01	3.02	5.10	3.06	3.07	4.03	2.82	1.61	2.11	4.51	2.97	4.61	4.81
187301	0.99	3.64	3.47	4.94	4.20	3.19	3.04	5.40	3.57	3.41	4.11	2.97	1.70	2.72	4.42	3.12	4.71	5.10
187302	2.44	10.81	10.33	14.14	12.00	9.08	8.66	16.21	9.26	10.24	12.34	8.98	4.95	7.87	15.64	10.01	16.65	17.32
187303	2.34	9.61	9.18	12.57	11.13	8.09	9.37	14.43	8.66	9.53	11.44	8.82	4.65	7.05	17.52	11.06	17.21	17.91
187442	1.12	4.75	4.54	6.40	5.47	4.02	4.04	7.03	4.10	4.11	5.62	4.17	2.31	3.70	7.59	5.02	7.76	8.06
187483	2.53	10.57	10.19	13.72	11.97	8.85	9.25	15.99	10.15	10.18	12.74	9.94	5.69	8.35	22.38	14.27	23.53	23.57
188301	1.09	5.28	4.31	4.69	3.96	3.61	2.80	4.33	2.36	2.22	2.98	2.23	1.41	1.69	2.86	2.13	2.74	2.90
188302	1.22	5.95	4.81	4.82	3.67	2.93	2.38	4.17	2.40	2.41	2.97	2.42	1.55	1.93	3.32	2.36	3.22	3.22
188303	1.95	9.72	8.15	7.88	5.91	4.68	3.77	6.89	3.99	3.82	4.96	4.04	2.60	3.26	5.93	4.39	5.83	6.05
188441	0.95	4.60	3.53	3.54	2.74	2.02	1.74	3.06	1.75	1.75	2.17	1.76	1.11	1.37	2.64	1.93	2.51	2.66
188481	0.63	3.91	3.16	3.16	2.48	1.72	1.60	2.63	1.50	1.38	1.87	1.52	0.95	1.42	2.85	2.07	2.76	2.76
188483	0.62	4.04	3.18	3.03	2.43	2.00	1.73	2.61	1.76	1.49	1.92	1.80	1.54	2.27	4.25	3.76	4.89	5.10
191301	1.28	5.60	3.91	4.62	3.10	2.79	2.64	3.58	1.94	1.94	2.64	2.21	1.41	1.67	2.21	2.07	2.50	2.64
191302	2.18	8.08	6.45	6.46	4.23	3.30	2.87	4.75	3.03	3.03	3.78	3.48	2.36	2.77	3.97	3.37	4.16	4.32
191303	1.62	8.07	5.44	5.88	4.32	3.15	2.54	4.35	2.88	2.44	3.54	3.24	2.36	2.98	4.53	3.87	5.00	5.40
191481	1.16	4.74	3.62	3.77	2.77	1.86	1.74	2.63	1.62	1.51	2.11	1.99	1.39	1.86	2.77	2.63	3.33	3.33
192301	1.00	5.64	4.03	3.87	2.54	2.28	1.76	2.84	1.66	1.79	2.18	1.93	1.57	1.83	2.24	1.87	2.69	2.84
192302	0.88	5.55	3.50	3.66	2.51	2.12	1.74	2.66	1.64	1.76	2.15	2.03	1.55	2.06	2.61	2.10	2.93	3.08
192303	1.13	5.94	3.60	3.77	2.72	2.18	2.05	2.88	1.93	1.68	2.35	2.22	1.71	2.25	3.11	2.70	3.46	3.62
192451	0.87	3.87	2.94	2.65	1.82	1.44	1.31	2.07	1.30	1.42	1.66	1.53	1.15	1.38	1.74	1.47	1.96	2.09

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 11

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
192481	0.79	3.32	2.64	2.14	1.43	1.20	0.98	1.53	0.97	0.97	1.29	1.29	1.06	1.38	2.32	2.70	2.95	3.08
192482	0.70	4.30	3.30	2.27	1.74	1.36	1.24	1.63	1.14	1.03	1.54	1.55	1.57	2.25	3.47	3.66	4.37	4.38
192483	0.89	5.14	3.91	2.98	2.41	1.75	1.75	2.15	1.76	1.64	2.03	2.16	2.17	3.01	4.46	4.64	5.40	5.59
213121	1.00	6.77	3.96	3.25	2.14	1.85	1.42	2.14	1.29	1.30	1.86	1.86	1.04	1.18	1.89	1.90	1.91	1.91
213122	1.12	6.16	3.90	2.88	1.83	1.41	1.15	1.84	1.03	1.03	1.57	1.44	0.67	0.93	1.48	1.35	1.65	1.79
213301	1.36	8.15	5.08	4.04	2.69	2.16	1.65	2.57	1.55	1.68	2.33	2.21	1.23	1.48	2.01	1.91	2.33	2.47
213302	1.09	6.68	3.92	3.31	2.22	1.85	1.49	2.11	1.39	1.40	1.89	1.90	1.08	1.33	2.08	1.98	2.14	2.15
213303	1.07	6.56	4.17	2.97	2.05	1.68	1.45	2.06	1.35	1.35	1.96	1.84	1.03	1.27	2.00	1.77	2.04	2.04
213311	0.74	6.14	4.01	2.97	2.05	1.68	1.45	2.06	1.35	1.35	1.96	1.72	1.03	1.27	2.00	1.89	2.16	2.17
213312	1.30	6.89	4.55	3.36	2.44	1.96	1.61	2.31	1.49	1.60	2.18	1.93	1.25	1.46	2.26	1.89	2.24	2.23
213313	1.47	8.54	5.90	4.39	3.25	2.51	2.24	3.24	2.93	2.93	3.70	3.54	1.82	2.07	2.90	2.61	2.88	3.03
213321	1.82	10.93	7.83	5.54	3.45	3.18	2.80	4.11	2.65	2.77	3.65	3.37	2.13	2.46	3.29	3.00	3.62	3.75
213322	0.85	5.25	2.98	2.70	1.91	1.42	1.42	1.79	1.19	1.19	1.66	1.54	0.96	1.19	1.66	1.54	1.79	1.91
213323	0.91	5.63	3.37	2.68	1.80	1.45	1.33	1.91	1.22	1.33	1.79	1.66	0.98	1.20	1.65	1.64	1.74	1.86
213391	1.17	6.64	4.42	3.34	2.65	1.76	1.53	2.26	1.53	1.53	2.02	1.90	1.20	1.32	1.80	1.69	1.94	2.06
213392	0.83	5.45	3.33	2.64	1.87	1.40	1.17	1.88	1.17	1.17	1.52	1.52	0.85	0.96	1.42	1.19	1.54	1.66
213393	0.96	12.31	8.42	6.11	4.28	3.29	3.02	4.43	2.76	2.76	3.98	3.83	2.27	2.63	3.68	3.13	3.96	3.96
213411	0.99	6.43	4.21	3.19	2.18	1.67	1.44	2.28	1.44	1.44	2.01	1.85	1.09	1.23	1.62	1.55	1.96	2.05
213412	1.02	6.57	4.19	3.21	2.18	1.65	1.39	2.05	1.27	1.27	1.78	1.78	1.02	1.14	1.78	1.78	1.91	1.91
213413	1.02	6.16	4.82	2.97	1.88	1.60	1.32	1.89	1.06	1.20	1.76	1.63	0.82	1.09	1.52	1.39	1.69	1.84
213421	1.04	6.54	4.10	3.02	2.06	1.62	1.34	2.07	1.21	1.21	1.64	1.65	0.96	1.11	1.69	1.70	1.87	1.87
213422	0.85	5.91	3.70	2.69	1.79	1.51	1.24	1.79	1.11	1.11	1.65	1.51	0.85	1.11	1.51	1.51	1.79	1.94
213423	0.98	6.75	4.19	3.32	2.08	1.66	1.26	2.10	1.27	1.28	1.83	1.69	0.91	1.17	1.59	1.60	1.76	2.04
213431	1.28	8.22	4.99	4.07	2.63	2.19	1.78	2.77	1.77	1.77	2.46	2.32	1.50	1.62	2.15	2.00	2.42	2.56
213432	0.98	7.01	4.38	3.15	2.08	1.53	1.26	2.10	1.27	1.15	1.33	1.69	0.91	1.17	1.73	1.60	1.90	2.04
213433	1.28	8.80	5.65	4.26	2.52	2.79	2.01	2.93	1.89	1.89	2.66	2.40	1.43	1.67	2.17	2.05	2.44	2.58
213434	1.17	8.28	5.28	3.95	2.52	2.02	1.77	2.67	1.67	1.79	2.55	2.17	1.33	1.46	1.95	1.72	2.22	2.35
213441	1.32	8.76	5.72	4.10	2.88	2.33	1.94	3.03	1.94	1.94	2.60	2.46	1.44	1.69	2.07	2.07	2.33	2.46
213442	1.57	11.36	7.00	5.35	3.64	2.90	2.49	3.65	2.36	2.36	3.21	3.06	1.73	1.99	2.66	2.40	2.96	3.25
213443	1.70	11.76	7.98	5.75	3.98	3.07	2.65	3.99	2.52	2.53	3.54	3.39	2.02	2.29	3.00	2.73	3.33	3.48
213451	2.25	13.90	8.69	6.93	4.38	3.12	3.12	4.75	3.00	3.15	4.09	3.93	2.33	2.62	3.51	3.09	4.03	4.20
213452	1.49	9.45	5.93	4.59	3.13	2.42	2.28	3.14	2.02	2.02	2.85	2.71	1.65	1.78	2.45	2.46	2.75	2.90
213453	1.95	13.04	8.78	6.36	4.47	3.51	3.07	4.49	2.80	2.94	4.01	3.70	2.82	2.43	3.29	3.01	3.63	3.94
213461	1.08	6.88	4.22	3.29	2.20	1.82	1.58	2.34	1.47	1.47	2.09	1.97	1.14	1.26	1.75	1.52	1.90	2.03
213462	1.28	7.07	4.25	3.33	2.38	2.00	1.63	2.38	1.64	1.64	2.13	2.01	1.29	1.41	1.77	1.66	2.03	2.15

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 11

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
213463	0.10	4.84	3.15	2.22	1.50	1.16	0.94	1.62	0.94	0.83	1.39	1.28	0.63	0.73	1.29	0.96	1.41	1.41
213471	0.82	6.30	4.12	3.06	1.98	1.60	1.48	1.96	1.23	1.23	1.82	1.69	0.87	1.19	2.15	1.39	1.74	1.73
213472	1.27	8.63	5.56	4.20	3.90	1.87	1.99	2.77	1.64	1.88	2.65	2.39	1.43	1.67	2.29	2.06	2.58	2.71
213473	1.30	9.26	5.93	4.32	3.10	2.16	2.03	3.11	1.92	2.04	2.84	2.70	1.56	1.94	3.14	3.15	3.45	3.60
213481	0.72	4.67	3.27	2.28	1.71	1.28	1.07	1.58	0.95	1.04	1.34	1.22	0.71	0.89	1.26	1.35	1.52	1.52
213482	1.07	6.43	4.20	3.12	1.90	1.78	1.53	2.16	1.41	1.53	2.02	1.77	1.17	1.28	2.27	1.76	2.00	2.13
213483	0.82	6.83	4.58	3.30	2.18	1.72	1.50	2.27	1.48	1.58	2.13	2.00	1.23	1.42	2.17	2.03	2.35	2.46

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 12

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
134331	1.18	3.78	2.57	2.82	1.94	1.48	1.26	2.54	1.35	1.24	1.45	1.22	1.00	1.20	1.85	1.60	1.92	1.92
134332	1.21	3.73	2.75	2.88	1.86	1.38	1.38	2.58	1.36	1.24	1.57	1.44	1.20	1.41	1.72	1.58	2.02	2.01
134333	1.55	5.18	3.45	4.03	2.62	1.99	1.98	3.27	1.97	1.84	2.32	1.95	1.58	1.80	2.39	2.00	2.61	2.73
134491	1.21	4.30	2.87	3.28	2.11	1.53	1.53	2.86	1.63	1.41	1.86	1.62	1.18	1.62	2.44	2.07	2.43	2.42
134492	0.90	3.61	2.39	2.52	1.78	1.21	1.21	1.89	1.20	1.20	1.53	1.53	1.30	1.63	2.10	1.97	2.46	2.46
150101	1.12	8.05	5.55	4.06	3.05	2.27	1.90	3.05	2.02	1.78	2.64	2.39	1.32	1.43	2.13	2.00	2.37	2.49
150102	1.34	7.59	5.20	4.53	3.19	2.40	2.03	3.19	1.91	1.91	2.53	2.28	1.23	1.56	2.40	2.16	2.79	2.79
150103	1.57	12.89	8.85	6.48	4.32	3.34	2.83	4.62	2.71	2.83	3.89	3.61	2.01	2.35	3.48	3.21	4.03	4.17
150201	1.14	9.10	6.47	4.16	2.94	2.22	1.99	3.19	1.76	2.09	2.80	2.44	1.42	1.63	2.54	2.29	2.77	2.89
150202	0.96	6.58	4.68	3.16	2.19	1.67	1.46	2.27	1.33	1.33	1.96	1.67	0.90	1.08	1.74	1.53	1.96	2.03
150203	0.93	6.73	4.52	3.24	2.32	1.70	1.57	2.40	1.51	1.51	2.03	1.89	1.09	1.38	1.96	1.89	2.32	2.40
150341	1.29	6.53	4.14	3.37	2.52	2.00	1.75	2.52	1.51	1.63	2.12	1.99	1.15	1.50	2.50	2.24	2.36	2.36
150342	0.96	6.46	4.36	3.33	2.28	1.79	1.79	2.38	1.42	1.41	2.10	1.85	1.05	1.24	2.01	1.62	2.06	2.05
150343	1.32	8.52	5.34	4.33	3.14	2.47	2.09	3.26	1.95	2.07	2.69	2.42	1.45	1.66	2.63	2.22	2.84	2.83
150391	0.63	4.71	2.98	2.43	1.79	1.31	1.07	1.79	1.07	1.07	1.42	1.42	0.74	0.85	1.31	1.07	1.42	1.42
150392	0.74	5.83	3.74	2.86	2.06	1.56	1.45	2.06	1.22	1.34	1.82	1.70	0.89	1.12	1.72	1.49	1.74	1.87
150393	1.79	9.52	6.56	4.81	2.83	2.57	2.45	3.60	2.31	2.43	3.18	2.91	1.71	2.04	3.12	2.60	3.21	3.21
153391	0.44	3.59	2.55	2.83	2.69	1.63	1.88	2.70	1.39	1.51	1.77	1.39	0.69	0.93	1.92	1.55	1.94	1.94
153392	0.90	5.35	4.09	4.27	3.94	2.45	2.59	4.13	2.06	2.34	2.76	2.09	1.10	1.60	2.82	2.29	3.02	3.02
153393	0.95	5.46	4.10	4.26	3.80	2.66	2.60	4.12	2.15	2.41	2.82	2.17	1.22	1.69	3.56	2.86	3.58	3.59
157201	1.11	4.60	4.08	4.10	3.51	2.74	2.40	3.57	2.57	2.58	2.97	2.53	1.66	2.29	3.41	2.86	3.83	3.85
157203	1.08	8.75	7.47	6.13	5.23	4.20	3.64	5.12	3.38	3.23	3.84	3.89	3.23	5.05	8.84	8.34	13.15	13.19
157331	1.12	5.04	3.93	4.40	3.26	2.62	2.61	3.78	2.22	2.33	2.81	2.18	1.49	1.79	2.70	2.17	3.00	2.99
157332	0.63	4.20	3.27	3.57	2.70	2.04	2.04	3.13	1.91	1.91	2.17	1.79	1.19	1.42	2.43	2.17	2.70	2.70
157333	1.01	4.92	3.80	4.10	3.64	2.53	2.40	3.49	2.02	2.26	2.64	2.01	1.30	1.63	2.74	1.84	2.72	2.71
158101	3.41	9.61	7.93	8.74	6.13	4.46	4.30	7.04	3.70	3.86	4.71	3.75	2.08	2.79	5.21	4.23	6.48	6.49
158102	2.24	6.06	5.04	6.07	3.47	3.16	3.17	4.70	2.31	2.45	3.21	2.47	1.42	1.82	3.28	2.71	3.66	3.67
158202	3.26	10.03	8.39	9.37	6.59	5.28	4.89	7.69	4.22	4.23	5.23	4.68	3.18	4.61	8.62	7.13	11.94	11.96
159203	2.11	6.90	5.68	5.94	4.48	3.39	2.90	4.75	2.62	2.68	3.21	2.91	2.18	3.18	7.41	6.98	11.13	11.15
158321	1.86	4.24	3.42	4.07	2.54	2.27	2.41	3.43	2.01	1.88	2.41	1.88	1.26	1.50	2.29	1.89	2.43	2.57
158322	1.79	4.56	3.70	4.57	2.64	2.35	2.36	3.72	1.96	1.96	2.66	2.11	1.33	1.72	2.70	2.15	2.87	2.88
158323	1.65	4.82	3.99	4.99	2.68	2.54	2.41	4.00	2.15	2.16	2.68	1.19	1.43	1.67	3.11	2.30	3.27	3.27
159381	1.63	4.42	4.10	5.47	3.65	3.07	2.40	4.44	2.81	2.54	3.23	2.69	1.80	2.18	2.99	2.08	3.01	3.16
159382	0.54	1.87	1.74	2.41	1.60	1.34	1.10	1.85	1.21	1.08	1.45	1.19	0.83	1.05	1.41	1.15	1.50	1.50
159383	1.09	3.64	3.18	4.28	3.19	2.35	1.83	3.50	2.23	1.97	2.64	2.37	1.60	1.99	2.94	2.13	3.10	3.25

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 12

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
159411	1.32	3.17	3.03	4.03	2.88	2.23	1.98	3.27	1.97	1.84	2.45	1.95	1.24	1.68	2.14	1.76	2.35	2.34
159412	1.30	4.11	3.77	5.03	3.45	2.69	2.40	4.14	2.56	2.28	3.02	2.58	1.89	2.46	3.22	2.64	5.36	5.56
159413	1.27	3.85	3.52	4.37	3.05	2.61	2.32	3.52	2.32	2.05	2.75	2.46	1.78	2.32	3.36	2.90	3.68	3.85
160101	2.13	7.01	4.95	6.40	4.00	3.70	2.74	5.28	3.28	2.87	3.70	3.13	1.99	2.48	3.13	2.60	3.53	3.53
160102	3.34	13.07	11.24	11.67	7.89	6.13	4.87	9.13	5.74	4.92	6.93	6.00	3.69	4.44	6.11	5.11	6.91	6.93
160202	1.25	5.47	3.73	3.89	3.00	2.44	1.80	2.74	2.08	1.83	2.37	2.51	2.13	2.83	3.91	3.94	4.82	5.00
160203	0.79	4.31	2.54	2.39	1.71	1.41	0.61	1.16	0.44	0.32	0.86	0.77	0.84	1.61	2.86	3.01	4.01	4.05
160321	1.22	4.00	2.92	3.52	2.09	1.96	1.58	3.07	1.71	1.58	1.96	1.84	1.10	1.46	2.23	1.84	2.09	2.09
160322	1.27	4.73	3.46	4.23	2.75	2.22	1.84	3.45	2.21	1.96	2.47	2.20	1.46	1.70	2.85	2.30	2.69	2.69
160323	0.95	4.03	2.97	3.71	2.28	1.77	1.52	2.82	1.76	1.39	2.01	1.75	1.15	1.26	2.51	2.10	2.35	2.35
161101	1.87	6.71	5.67	7.42	4.94	3.77	3.17	5.54	3.05	2.92	3.33	3.54	1.65	2.18	4.43	3.22	4.51	4.52
161102	3.53	12.03	10.09	13.46	9.16	7.25	5.88	10.56	5.73	5.75	7.36	6.02	3.50	4.38	8.07	6.04	8.49	8.51
161104	1.29	6.09	4.91	6.32	4.24	3.60	2.56	4.63	2.33	2.34	3.22	2.66	1.27	1.92	4.31	3.41	4.94	5.32
161105	2.23	8.77	7.30	9.47	6.35	4.83	4.08	7.18	3.79	3.64	4.79	4.07	2.18	3.16	6.55	5.13	7.50	7.52
161107	1.00	3.97	3.32	4.26	2.86	2.22	2.22	3.22	1.75	1.75	2.25	1.86	1.15	1.60	3.05	2.41	3.21	3.33
161109	1.03	3.45	2.90	3.81	2.89	1.92	1.75	2.99	1.74	1.65	2.09	1.90	1.22	1.63	2.95	2.43	3.14	3.14
161201	1.50	5.37	4.46	5.90	4.97	3.33	2.80	4.37	2.18	2.36	3.09	2.43	1.52	1.88	3.68	2.69	3.86	3.88
161202	1.16	5.07	4.17	5.12	4.28	2.39	2.07	3.78	1.87	1.74	2.30	2.02	1.03	1.58	3.58	2.67	4.28	4.32
161203	1.57	6.61	5.28	6.17	4.94	3.68	3.53	5.01	3.11	2.97	3.66	3.36	2.48	3.46	6.62	6.25	8.58	8.89
161204	2.68	10.05	8.40	9.66	7.79	5.96	5.19	7.58	4.12	4.38	5.67	5.22	4.12	5.64	10.87	10.13	13.84	13.88
161208	1.40	5.01	3.75	4.15	2.49	1.95	1.44	2.13	1.19	0.62	1.07	0.73	0.58	2.01	4.86	4.60	6.61	7.00
161209	0.86	3.43	2.57	2.79	2.52	1.79	1.27	1.59	0.89	0.68	1.11	1.42	1.23	2.42	5.40	6.03	8.83	9.30
161331	0.75	3.08	2.67	3.67	2.40	1.89	1.77	2.80	1.41	1.52	1.89	1.41	0.73	1.06	2.01	1.64	1.89	2.01
161332	1.11	3.89	3.31	4.35	3.02	2.37	2.11	3.57	1.74	1.86	2.47	1.73	1.15	1.36	2.42	1.91	2.38	2.51
161333	1.58	5.04	4.00	5.62	4.00	3.07	2.92	4.33	2.36	2.50	3.07	2.50	1.34	1.71	3.37	2.36	3.07	3.07
163101	2.51	8.53	6.03	6.65	4.93	4.10	3.20	6.45	3.35	3.36	3.96	3.36	2.41	2.81	3.68	2.97	4.16	4.48
163102	2.04	7.93	5.84	6.27	4.00	3.52	2.63	5.47	2.93	2.94	3.72	2.96	1.99	2.41	3.62	2.74	3.33	4.16
163201	2.61	9.06	6.35	7.48	5.55	4.82	3.81	6.80	3.82	3.67	4.66	3.68	2.53	3.24	4.36	3.57	4.72	5.08
163202	2.30	8.84	6.34	6.96	4.90	3.96	3.67	6.37	3.69	3.40	4.45	3.85	2.89	3.73	5.00	4.53	5.92	6.11
163203	2.20	9.41	6.10	6.55	4.77	3.77	3.62	5.58	3.51	3.36	4.19	4.04	3.44	4.79	6.62	6.25	7.66	8.17
163331	1.33	4.90	3.63	4.24	2.78	2.51	2.25	4.05	2.23	2.22	2.73	2.20	1.58	1.92	2.66	2.12	2.87	3.01
163332	0.90	4.31	2.97	3.61	2.23	1.78	1.67	3.18	1.64	1.64	2.06	1.61	1.08	1.36	2.44	1.95	2.49	2.61
163333	1.73	6.79	4.76	5.51	4.06	3.11	2.96	4.94	2.82	2.82	3.57	2.82	1.99	2.39	3.42	2.82	3.73	3.90
168101	0.73	2.97	2.23	2.58	1.80	1.41	1.11	1.95	1.10	1.02	1.53	1.37	0.86	1.20	1.71	1.45	1.99	1.99
168201	0.74	2.87	2.29	2.38	1.50	1.03	0.81	1.50	0.74	0.74	1.11	0.96	0.67	1.03	1.58	1.34	1.84	1.84

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 12

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
168202	1.13	4.94	4.01	3.81	3.02	2.29	1.78	2.90	2.03	1.70	2.44	2.47	1.98	3.13	4.70	4.77	5.60	5.63
168331	1.10	3.84	3.14	3.55	2.35	2.10	1.63	2.98	1.51	1.62	2.08	1.84	1.16	1.48	2.29	1.92	2.39	2.39
168332	1.13	3.69	3.21	3.60	2.55	2.06	1.83	3.02	1.80	1.79	2.24	1.99	1.42	1.61	2.26	1.88	2.43	2.42
168333	0.82	3.20	2.50	2.90	2.48	1.83	1.58	2.33	1.32	1.43	1.91	1.53	1.05	1.26	1.84	1.45	2.04	2.03
176101	0.54	3.02	2.65	3.60	3.07	2.25	2.15	3.83	2.30	2.42	3.05	2.25	1.33	2.01	4.04	2.76	4.48	4.67
176103	0.65	3.53	3.09	4.05	3.28	2.51	2.52	4.12	2.69	2.82	3.54	2.75	1.78	2.35	4.90	3.75	5.44	5.68
176201	0.91	4.36	4.01	5.29	4.22	3.09	2.90	5.26	3.06	3.44	4.06	2.77	1.39	2.11	4.11	2.78	4.55	4.54
176203	1.02	4.38	4.22	5.33	4.60	3.28	3.42	5.61	3.46	3.61	4.37	3.39	1.92	3.09	6.05	4.27	6.92	7.22
176321	0.83	3.18	3.04	3.77	3.04	2.37	2.37	4.08	2.37	2.63	3.04	2.37	1.27	1.99	3.18	2.50	3.33	3.47
176322	0.69	2.78	2.65	3.47	2.91	2.27	2.15	3.61	2.02	2.39	2.91	2.14	1.21	1.77	3.03	2.37	3.16	3.16
176323	1.05	4.41	4.09	5.27	4.25	3.34	3.63	5.46	3.34	3.79	4.42	3.34	1.88	2.65	4.43	3.50	4.78	4.95
178101	0.90	5.69	4.72	5.09	3.83	2.88	2.73	4.52	2.58	2.72	3.33	2.71	1.60	2.13	3.46	2.68	3.77	3.77
178102	0.83	3.92	3.35	3.68	2.81	2.23	2.05	3.31	1.94	2.03	2.57	2.01	1.26	1.64	2.70	2.02	2.85	2.84
178103	0.62	4.14	3.38	3.75	2.92	2.20	1.92	3.26	1.83	2.01	2.59	2.00	1.22	1.63	2.90	2.18	3.00	3.11
178201	0.79	4.04	3.36	3.76	2.76	2.11	1.81	3.52	1.92	2.03	2.46	2.04	1.20	1.58	2.62	2.00	2.77	2.89
178202	1.06	5.10	3.99	4.71	3.65	2.86	2.41	4.18	2.42	2.42	3.18	2.72	1.74	2.44	4.04	3.38	4.78	4.97
178203	0.70	5.03	3.94	4.30	3.46	2.55	2.13	3.64	2.29	2.02	2.74	2.17	1.52	2.34	4.41	3.92	6.01	6.23
178301	1.03	4.32	4.03	4.48	3.10	2.74	2.30	4.49	2.53	2.42	2.88	2.21	1.34	1.62	2.56	1.93	2.58	2.81
178302	0.93	4.77	3.85	4.57	3.34	2.55	2.11	4.19	2.54	2.39	3.16	2.24	1.27	1.67	2.81	2.06	2.79	3.11
178303	1.09	5.11	4.27	5.12	3.69	2.90	2.43	4.96	2.56	2.68	3.45	2.47	1.54	1.95	3.37	2.31	3.15	3.28
180101	0.30	1.56	1.57	2.60	1.99	1.45	1.45	2.74	1.62	1.71	2.04	1.43	0.77	1.18	2.29	1.75	3.01	3.12
180103	0.71	2.54	2.42	3.95	3.02	2.37	2.26	4.23	2.57	2.71	3.30	2.39	1.65	2.47	5.14	3.71	5.48	5.98
180331	0.73	2.42	2.42	4.03	3.11	2.41	2.54	4.18	2.54	2.81	3.24	2.13	1.50	1.87	2.93	2.37	3.65	3.80
180332	0.64	2.31	2.44	3.74	3.00	2.45	2.32	4.07	2.46	2.60	3.02	1.83	1.35	1.96	3.04	2.50	3.80	3.81
180333	0.93	3.12	2.97	5.03	3.78	3.14	3.14	5.25	3.01	3.32	3.98	2.87	1.76	2.60	4.03	2.93	4.78	4.98
186311	1.61	6.19	4.64	4.80	3.45	2.78	2.29	4.16	2.28	2.40	3.16	2.51	1.68	2.25	2.99	2.72	3.37	3.51
186312	1.02	4.14	3.02	3.17	2.59	1.91	1.52	2.74	1.53	1.66	2.05	1.67	1.17	1.42	2.08	1.69	2.23	2.37
186313	1.58	7.61	5.11	5.73	4.19	3.19	2.88	4.94	2.75	2.90	3.71	3.07	2.05	2.49	3.93	2.98	3.97	4.14
186321	0.86	4.07	3.35	3.21	2.17	1.70	1.47	2.65	1.34	1.56	1.89	1.42	0.98	1.28	2.06	1.69	2.01	2.00
186322	1.06	4.99	4.15	3.99	2.81	2.15	2.02	3.53	1.66	1.78	2.55	2.03	1.31	1.67	2.83	2.17	2.57	2.71
186323	0.91	4.88	3.70	3.83	2.75	2.03	2.02	3.37	1.77	1.87	2.44	1.95	1.27	1.68	2.57	2.29	2.61	2.60
186381	0.76	4.17	2.93	3.22	2.24	1.72	1.47	2.79	1.48	1.60	2.11	1.60	1.01	1.36	1.86	1.37	1.87	2.00
186382	1.12	5.51	3.90	4.23	2.96	2.39	1.86	3.57	1.99	2.12	2.67	2.12	1.48	1.73	2.67	2.12	2.82	2.96
186383	0.73	4.14	3.08	3.08	2.27	1.77	1.41	2.53	1.29	1.41	1.77	1.52	0.95	1.29	1.89	1.41	2.01	2.01
186391	1.09	5.46	4.07	4.23	2.88	2.34	2.21	3.62	3.48	1.97	2.63	2.11	1.27	1.64	2.28	1.79	2.45	2.59

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 12

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
186392	0.87	4.01	2.93	2.93	2.65	1.85	1.72	2.51	1.35	1.48	1.98	1.60	1.01	1.24	1.99	1.49	1.87	2.00
186393	1.38	6.49	4.90	4.90	3.84	2.77	2.77	4.13	2.27	2.52	3.15	2.64	1.69	2.15	3.27	2.62	3.40	3.39
186411	1.15	4.72	3.76	3.75	2.61	2.21	1.96	3.44	1.82	2.07	2.45	1.93	1.33	1.67	2.55	1.89	2.39	2.51
186412	1.03	5.32	3.70	4.04	2.93	2.21	1.81	3.40	1.96	1.96	2.52	2.24	1.33	1.99	2.84	2.15	2.87	2.88
186431	1.02	4.64	3.69	3.39	2.29	1.79	1.55	2.80	1.53	1.65	2.13	1.75	1.16	1.61	2.33	2.05	2.54	2.67
186461	1.02	4.54	3.36	3.52	2.61	2.05	1.65	3.21	1.65	1.78	2.32	1.91	1.27	1.52	2.18	1.78	2.18	2.32
186462	1.10	5.36	3.30	3.97	2.92	2.37	1.86	3.37	1.87	1.87	2.53	2.01	1.40	1.78	2.58	2.07	2.62	2.76
186463	0.71	4.06	2.90	2.91	2.17	1.63	1.24	2.33	1.38	1.39	1.79	1.53	1.16	1.55	2.40	1.86	2.45	2.45
186471	0.96	4.21	3.13	3.28	3.14	2.05	1.55	2.72	1.44	1.56	1.93	1.56	1.09	1.45	2.20	1.95	2.21	2.47
186472	1.61	7.64	5.66	5.87	4.92	3.44	2.86	4.77	2.74	2.89	3.64	3.06	2.11	2.95	4.20	3.60	4.11	4.44
186473	1.33	5.92	4.27	4.11	3.33	2.34	2.08	3.48	2.08	2.21	2.76	2.48	1.83	2.49	3.50	3.20	3.98	4.14
186481	0.81	4.27	3.52	3.23	2.30	1.69	1.46	2.81	1.45	1.57	1.92	1.57	1.11	1.33	2.16	1.67	2.27	2.27
186482	0.91	4.73	3.69	3.37	2.47	1.79	1.66	2.91	1.53	1.66	2.06	1.93	1.29	1.67	2.49	2.08	2.65	2.79
186483	0.95	5.04	3.86	3.54	2.67	2.00	1.74	2.93	1.73	1.85	2.23	1.96	1.58	1.94	3.16	2.57	3.27	3.26
186491	0.92	4.71	3.30	3.59	2.72	2.06	2.06	3.27	1.67	1.91	2.28	1.77	1.29	1.63	2.62	2.34	2.71	2.71
186492	1.51	5.26	4.24	4.08	3.04	2.11	2.11	3.47	1.86	2.11	2.63	2.24	1.62	2.24	3.77	3.93	4.40	4.57
186493	0.88	4.58	3.42	3.11	2.67	1.99	2.26	2.53	1.60	1.60	1.99	1.73	1.36	1.86	2.82	2.26	2.96	2.96

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 14

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
309101	1.94	5.69	3.93	4.18	2.77	2.59	1.64	3.37	2.01	1.71	2.25	2.09	1.57	1.94	2.01	1.86	2.50	2.59
309201	1.21	5.71	3.82	3.23	2.06	1.73	1.21	1.73	1.21	1.28	1.66	1.81	1.58	1.90	2.24	2.42	3.01	3.12
309331	1.30	3.65	2.58	3.23	2.44	1.84	1.06	2.68	1.05	1.27	1.15	1.15	0.83	1.24	1.56	1.55	1.88	1.87
403331	0.91	3.93	3.26	4.21	2.73	2.84	3.22	4.31	1.65	1.53	1.96	1.51	1.17	1.36	1.86	1.50	1.56	1.66
403333	1.16	5.12	3.71	4.51	2.82	2.43	2.88	3.41	1.99	1.73	2.25	1.99	1.73	1.99	2.81	2.53	3.72	3.88
407341	1.53	5.50	5.35	5.65	3.19	3.09	1.91	3.94	2.11	1.98	2.23	1.98	1.61	1.98	2.23	2.11	3.19	3.19
407342	1.42	5.20	3.92	4.56	3.14	2.58	1.92	3.59	1.99	1.86	2.26	1.86	1.47	1.73	2.26	2.12	3.12	3.12
407343	1.42	5.40	4.10	4.56	3.14	2.58	1.92	3.43	1.99	1.86	2.26	1.99	1.60	1.86	2.40	2.12	3.28	3.12
407461	1.47	5.46	4.17	4.64	3.37	2.66	1.99	3.51	2.06	1.93	2.20	1.93	1.67	1.93	2.34	2.20	3.20	3.20
407462	1.43	8.18	6.29	5.94	4.25	2.98	2.38	3.63	2.71	2.41	2.73	2.74	2.45	3.09	4.08	3.47	4.82	4.83
408101	2.17	3.74	2.79	3.60	2.06	1.87	1.50	2.45	1.24	1.15	1.40	1.14	0.82	0.97	1.46	1.19	1.61	1.70
408102	3.67	7.41	5.62	6.68	4.41	3.54	2.56	4.58	2.45	2.45	2.80	2.57	2.04	2.36	3.32	2.96	3.74	4.03
408201	2.11	3.67	2.83	3.54	2.00	1.90	1.44	2.39	1.26	1.18	1.43	1.17	1.00	1.16	1.68	1.40	1.84	1.94
408311	3.24	5.07	3.87	5.23	3.12	2.66	2.34	3.37	1.75	1.75	2.03	1.65	1.21	1.38	1.93	1.64	2.02	2.12
408312	2.83	4.81	3.71	4.82	2.58	2.38	1.81	3.37	1.65	1.56	2.02	1.49	1.16	1.25	1.78	1.45	1.99	2.09
408313	2.97	5.49	4.33	5.50	3.10	2.76	2.05	3.59	1.87	1.87	2.16	1.78	1.35	1.53	2.09	1.91	2.42	2.52
408321	3.42	5.67	4.30	5.55	3.11	2.92	2.34	3.91	2.02	1.93	2.28	1.85	1.39	1.61	2.10	1.85	2.37	2.47
408322	2.41	4.72	3.72	4.57	2.71	2.23	1.64	3.02	1.56	1.57	1.81	1.49	1.06	1.27	1.82	1.66	2.17	2.26
409101	1.78	5.25	4.52	6.25	3.98	3.85	3.07	6.12	3.62	2.65	3.49	2.55	1.51	1.86	2.76	2.14	2.55	2.65
409201	1.45	5.50	4.88	5.50	3.63	2.84	1.88	3.75	2.67	1.96	2.68	2.27	1.61	1.90	2.70	2.54	2.99	3.08
409202	1.70	8.61	6.32	5.52	3.56	2.44	1.39	5.19	3.03	2.36	2.33	2.31	2.50	3.57	4.21	4.89	5.84	6.36
409301	1.55	4.31	3.77	5.57	3.41	3.18	2.63	5.26	2.97	2.14	2.76	1.97	1.03	1.45	2.01	1.49	1.77	1.87
409302	1.64	4.90	4.30	5.99	4.17	3.55	2.70	5.43	3.33	2.34	3.23	2.27	1.41	1.72	2.48	1.90	2.34	2.43
409303	1.49	5.06	4.44	5.99	3.66	3.42	2.41	4.92	3.44	2.25	3.12	2.44	1.62	1.86	2.75	2.13	2.59	2.78
409491	1.83	5.53	4.78	6.79	4.25	3.95	3.03	6.12	3.72	2.81	3.56	2.67	1.73	2.12	3.25	2.67	3.41	3.41
411201	2.28	4.17	3.61	6.99	4.33	4.33	3.49	6.76	4.50	2.87	4.05	2.88	1.81	2.33	3.66	2.79	3.29	3.42
411301	2.59	3.93	3.53	6.93	4.51	5.87	4.98	9.16	4.49	3.78	4.05	2.67	1.37	2.03	2.87	1.91	2.10	2.30
411302	2.60	4.38	3.82	7.70	4.39	5.02	4.70	8.88	5.20	3.45	4.56	2.86	1.55	2.03	3.23	2.14	2.36	2.68
411303	2.70	5.00	4.34	9.20	5.01	5.57	4.20	8.87	5.99	3.64	5.41	3.52	2.10	2.43	2.68	2.58	3.07	3.46
412341	2.08	4.99	3.97	4.76	3.07	3.41	2.85	4.82	2.50	2.24	2.50	1.98	1.49	1.86	2.24	1.98	2.92	3.06
412342	1.85	4.86	3.79	4.43	2.70	2.74	2.19	4.13	2.40	1.99	2.55	2.13	1.47	1.86	2.40	2.13	2.99	2.99
412343	1.85	5.06	3.97	4.43	2.70	2.74	1.92	3.62	2.40	1.86	2.40	2.13	1.73	1.99	2.55	2.26	5.05	5.05
412421	1.98	4.99	4.28	4.56	2.83	3.02	2.61	4.44	2.54	2.12	2.54	2.26	1.73	1.99	2.54	2.40	3.28	3.43
412422	1.57	5.14	3.83	3.94	2.28	2.46	1.52	2.86	1.99	1.59	2.13	1.99	1.59	1.99	2.41	2.41	3.33	3.33
413101	1.95	5.58	4.96	8.59	5.11	4.29	3.30	7.43	5.26	3.50	5.11	3.20	1.47	1.95	3.50	2.25	2.83	2.83

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 14

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
413201	1.87	6.07	5.40	8.41	4.95	3.96	2.97	6.65	4.95	3.06	4.55	3.24	1.81	2.31	3.85	3.06	3.53	3.64
413301	2.11	4.81	3.94	8.09	4.36	5.47	4.81	9.31	5.30	3.42	4.50	2.72	1.28	2.00	2.72	1.71	1.99	2.09
413302	2.28	5.35	4.38	8.86	4.24	5.53	4.69	9.92	6.11	3.44	5.19	3.08	1.44	2.11	3.09	2.02	2.33	2.54
413303	1.94	5.03	4.09	8.40	3.95	4.87	3.54	8.11	5.57	3.04	4.87	3.04	1.47	1.95	3.05	2.06	2.38	2.48
414101	1.29	5.09	3.95	4.94	2.95	3.22	3.32	4.79	2.06	1.85	2.59	1.84	1.32	1.70	2.18	1.75	2.64	2.64
414201	1.47	6.15	4.36	4.99	3.23	3.06	3.60	4.58	2.56	1.93	2.73	2.56	1.93	2.41	2.91	2.74	3.27	3.63
414202	1.29	6.13	4.15	4.01	2.69	2.20	1.85	2.49	1.68	1.60	2.02	2.20	2.11	2.49	3.01	3.01	4.15	4.30
414331	0.85	3.04	2.41	3.17	2.15	2.50	2.63	3.69	1.21	1.21	1.53	1.08	0.76	1.06	1.57	1.33	1.75	1.74
414333	1.28	4.99	3.64	4.76	2.92	3.41	3.59	4.82	2.24	1.98	2.64	1.98	1.49	1.86	2.50	2.11	3.21	3.21
416341	1.81	5.38	4.48	6.81	3.84	4.04	3.13	6.59	4.14	2.78	3.97	2.78	1.49	1.98	2.78	2.11	3.06	3.06
416342	1.37	5.35	4.38	6.40	3.52	3.39	2.49	5.31	3.82	2.56	3.82	2.71	1.59	2.13	3.01	2.56	3.49	3.49
416343	1.44	5.43	4.25	5.80	3.38	2.93	2.21	4.40	3.52	2.28	3.35	2.72	1.72	1.99	3.03	2.72	3.69	3.69
416411	1.57	5.35	4.20	6.40	3.35	3.39	2.49	5.52	3.82	2.41	3.65	2.56	1.33	1.72	2.56	2.13	3.17	3.17
416412	1.29	5.35	4.20	5.28	3.03	2.76	1.92	3.65	3.01	1.99	2.86	2.41	1.59	1.99	2.86	2.71	3.65	3.65
417301	1.61	4.12	3.42	6.62	4.31	3.95	3.60	7.65	4.32	2.96	4.33	2.81	1.25	1.93	3.15	2.10	2.70	2.85
417302	1.41	4.70	4.53	6.73	4.21	3.72	2.96	6.35	4.09	3.15	4.81	3.49	1.82	2.37	4.22	3.02	3.98	4.16
417303	1.06	3.78	3.46	5.05	2.86	2.72	2.30	4.53	3.05	2.47	3.70	2.78	1.57	2.25	3.79	2.89	3.86	4.03
418301	1.08	3.42	2.77	4.67	2.62	2.78	2.47	5.07	2.78	2.04	2.94	2.04	0.98	1.37	2.06	1.51	1.79	1.93
418302	1.68	7.20	6.48	8.84	5.03	4.29	3.45	7.73	5.24	3.63	5.86	4.14	2.00	2.57	4.53	3.05	4.03	4.38
418303	2.10	9.49	8.80	11.09	7.31	5.33	4.69	9.57	6.83	5.17	7.69	5.65	2.95	3.68	6.74	4.74	6.60	6.86
421301	1.84	3.11	1.91	2.30	1.29	1.42	1.29	1.91	1.04	0.98	1.10	1.10	0.86	0.98	0.98	0.92	1.17	1.30
421311	2.02	4.58	3.02	4.04	2.28	3.02	2.45	3.45	1.58	1.80	1.58	1.66	1.30	1.52	1.45	1.32	1.67	1.90
421312	1.76	4.77	2.91	3.41	2.06	2.21	1.83	3.00	1.75	1.41	1.75	1.68	1.27	1.47	1.47	1.40	1.74	1.89
421313	1.61	5.63	3.23	3.45	2.00	2.09	1.32	2.44	1.54	1.40	1.85	1.77	1.33	1.47	1.55	1.48	1.86	2.02
421321	1.73	4.69	3.21	4.06	2.54	2.66	2.28	3.45	1.67	1.90	1.77	1.76	1.41	1.74	2.18	1.92	2.25	2.25
421322	1.52	4.29	2.66	3.21	1.87	1.87	1.50	2.78	1.50	1.38	1.61	1.61	1.25	1.48	1.59	1.46	1.81	1.93
421331	0.53	2.86	1.69	2.20	1.82	1.00	0.78	1.84	0.47	0.58	0.70	0.70	0.39	0.72	0.74	0.76	1.11	1.23
421391	2.42	6.81	4.10	4.74	3.07	3.07	1.55	3.78	2.39	2.02	2.64	2.38	1.88	1.99	2.10	1.97	2.45	2.71
421411	2.05	5.23	3.41	4.31	2.48	2.52	2.41	3.75	1.98	1.86	2.10	1.98	1.62	1.86	1.98	1.98	2.89	2.89
421421	2.53	4.86	3.35	4.64	2.94	3.91	2.72	3.69	1.86	2.11	1.86	1.98	1.61	1.86	1.98	1.98	2.94	2.79
421422	2.53	4.86	3.35	4.46	3.09	4.08	2.72	3.69	1.86	2.11	1.86	1.98	1.61	1.98	1.98	1.98	2.94	2.79
421423	2.40	5.12	3.38	4.51	2.82	3.62	2.74	3.88	1.86	2.25	1.86	1.99	1.60	1.86	1.86	1.99	2.81	2.81
421431	2.25	4.74	3.23	4.33	2.82	3.95	2.59	3.56	1.73	1.99	1.73	1.86	1.48	1.86	1.86	1.86	2.81	2.81
421432	2.25	4.93	3.23	4.51	2.82	3.78	2.74	3.72	1.73	1.99	1.73	1.86	1.60	1.86	1.86	1.86	2.81	2.67
421433	2.11	5.12	3.23	4.15	2.39	2.71	2.59	3.72	1.86	1.86	1.86	1.86	1.36	1.73	1.73	1.86	2.81	2.81

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 14

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
421461	2.31	5.19	3.30	4.58	2.75	3.08	2.67	3.80	1.80	2.06	1.80	1.93	1.55	1.80	1.80	1.80	2.60	2.60
421471	2.16	5.39	3.30	4.23	2.32	2.64	2.53	3.80	1.93	1.93	1.93	1.93	1.55	1.80	1.93	1.80	2.75	2.75
421472	1.58	6.40	3.52	2.88	2.17	1.95	1.37	1.93	1.45	1.45	1.81	2.06	1.81	2.06	2.31	2.57	3.56	3.56
421481	2.24	5.69	3.49	4.39	2.69	2.60	2.49	3.69	2.05	1.93	2.05	2.05	1.57	1.93	1.93	2.05	2.97	2.97
421491	2.27	5.72	3.61	4.45	2.70	2.82	2.57	3.84	2.08	1.96	2.29	2.17	1.60	2.02	2.44	2.18	2.49	2.61
422342	1.50	4.73	4.23	5.43	4.22	3.91	3.60	5.24	2.87	2.60	3.29	2.33	1.35	1.82	2.99	2.18	3.11	3.25
422343	1.07	3.49	2.94	3.76	2.66	2.16	1.80	3.58	2.13	1.89	2.48	1.75	1.07	1.26	2.16	1.65	2.22	2.33
422431	1.60	4.82	3.95	5.54	3.76	3.18	2.63	5.81	3.00	2.65	3.39	2.48	1.51	2.00	3.06	2.20	3.10	3.29
422432	1.16	4.42	3.48	4.62	3.32	2.82	2.04	4.25	2.51	2.05	2.84	2.06	1.22	1.64	2.72	1.96	2.75	2.92
423311	1.25	4.06	3.36	4.35	2.96	2.57	2.21	4.03	2.20	2.19	2.92	2.18	1.28	1.59	2.49	2.11	2.57	2.69
423312	1.45	4.32	3.50	4.48	3.81	2.89	2.47	3.96	2.45	2.59	3.32	2.58	1.52	1.89	2.98	2.13	2.95	3.09
423313	2.18	8.08	6.45	7.83	5.85	4.74	3.92	6.69	4.25	4.25	5.49	4.26	2.49	3.05	5.15	3.82	5.36	5.37
423321	1.22	3.74	2.90	3.74	2.63	2.37	1.99	3.57	1.98	1.98	2.59	1.84	1.04	1.36	2.05	1.67	2.26	2.25
423322	1.35	4.27	3.51	4.42	3.22	2.67	2.16	4.10	2.41	2.28	3.07	2.27	1.20	1.65	2.51	2.00	2.62	2.75
423323	1.46	5.26	4.10	5.25	3.49	3.06	2.65	4.55	2.77	2.77	3.60	2.76	1.50	1.97	3.41	2.70	3.37	3.37
423381	1.32	4.74	3.76	4.92	3.17	2.75	2.35	4.27	2.50	2.51	3.36	2.39	1.29	1.66	2.71	2.07	2.76	2.90
423382	1.56	5.46	4.07	5.28	3.76	3.17	2.61	4.42	2.90	2.90	3.64	2.92	1.75	2.13	3.39	2.43	3.43	3.43
423383	1.38	5.36	4.10	5.18	3.96	2.89	2.47	4.32	2.64	2.64	3.54	2.81	1.63	2.03	3.62	2.49	3.54	3.70
423391	1.91	5.62	4.36	5.81	3.87	3.41	2.83	5.24	3.11	2.97	3.87	2.82	1.64	1.89	2.81	2.14	2.80	2.94
423392	0.96	3.39	2.68	3.39	2.30	2.04	1.68	2.98	1.81	1.81	2.32	1.70	0.90	1.84	1.85	1.39	1.88	2.01
423393	1.02	3.81	2.95	3.51	2.17	2.04	1.80	3.21	1.91	1.91	2.53	1.90	1.09	1.31	2.25	1.64	2.23	2.23
423441	2.12	6.15	4.72	6.38	4.18	3.83	3.34	5.95	3.35	3.19	4.20	3.05	1.76	2.32	3.40	2.50	3.43	3.60
423451	1.24	3.77	2.99	3.77	2.54	2.26	1.98	3.59	2.11	1.97	2.52	1.83	1.19	1.42	2.20	1.52	2.17	2.16
423452	2.13	7.62	5.96	7.64	5.35	4.40	3.39	6.68	3.91	3.92	5.21	3.77	2.26	2.86	4.73	3.39	4.80	4.81
423453	1.47	5.20	4.07	5.01	3.91	3.09	2.48	4.29	2.65	2.66	3.45	2.83	1.56	2.12	3.68	2.75	5.80	5.80
423461	1.51	4.85	3.80	4.85	3.03	2.88	2.45	4.32	2.60	2.60	3.35	2.47	1.42	1.68	2.77	2.09	2.79	2.94
423462	1.38	5.36	4.10	4.99	3.64	2.89	2.34	4.32	2.64	2.64	3.54	2.67	1.50	1.90	3.17	2.36	3.24	3.40
423463	0.77	2.69	2.14	2.69	1.75	1.38	1.14	2.15	1.39	1.39	1.77	1.39	0.69	1.05	2.05	1.42	1.94	1.94
423471	1.91	5.56	4.53	5.74	4.06	3.47	2.92	5.38	3.06	3.06	3.91	2.92	1.68	2.16	3.47	2.40	3.33	3.33
423472	1.18	3.69	3.10	3.85	2.69	2.17	1.92	3.26	2.06	2.06	2.45	1.94	1.23	1.48	2.35	1.74	2.25	2.26
423473	1.01	3.56	2.83	3.24	2.39	1.87	1.74	2.76	1.69	1.81	2.30	1.52	1.14	1.46	2.56	2.11	3.16	3.14
423481	1.20	4.22	3.28	4.06	3.00	2.32	1.93	3.60	2.20	2.20	2.88	2.21	1.23	1.59	2.62	1.98	2.64	2.78
423482	0.98	4.33	3.46	3.98	3.15	2.25	2.11	3.51	2.13	2.14	2.74	2.46	1.50	2.07	3.63	2.71	3.87	3.88
423491	1.29	4.22	3.55	4.40	2.95	2.66	2.24	4.26	2.40	2.26	2.99	2.14	1.25	1.52	2.76	2.08	2.66	2.67
423492	1.06	3.45	2.84	3.31	2.28	1.75	1.49	2.89	1.39	1.65	2.20	1.55	0.83	1.34	2.57	2.74	3.54	3.55

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 14

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
423493	1.75	6.36	4.96	5.95	4.61	3.62	3.01	5.18	3.32	3.33	4.13	3.34	2.08	2.63	4.70	3.55	4.91	4.92
424491	1.66	4.92	3.92	5.45	3.05	3.09	2.69	4.94	3.33	2.36	3.04	2.36	1.61	1.98	2.63	2.23	3.19	3.19
426301	3.97	5.70	5.28	9.33	5.91	8.13	5.91	10.72	5.28	4.89	5.28	3.30	1.83	2.68	3.63	2.54	2.99	2.99
426302	3.36	5.39	4.60	8.61	4.99	6.04	5.20	9.57	4.81	4.25	4.82	3.08	1.63	2.48	3.58	2.50	2.81	2.97
426303	3.31	5.59	4.97	9.01	5.18	5.83	5.19	9.70	5.20	4.41	5.21	3.36	1.98	2.58	3.73	2.76	3.10	3.26
426461	3.18	4.99	4.45	8.27	4.66	5.49	4.92	9.11	4.61	3.90	4.43	2.94	1.66	2.35	3.57	2.79	3.41	3.41
426462	2.98	5.54	4.58	8.12	5.18	4.46	3.47	7.31	4.56	3.23	4.56	3.07	1.93	2.34	3.70	2.92	3.70	3.70
426491	3.02	5.12	4.41	8.08	4.98	5.02	4.67	8.31	4.56	3.72	4.39	2.95	1.86	2.53	3.72	2.95	3.72	3.72

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 16

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
601101	1.32	6.04	4.73	5.09	4.08	3.02	2.48	4.42	2.62	2.76	3.34	2.64	1.63	2.01	2.96	2.17	3.28	3.28
601201	1.32	6.17	4.70	5.06	4.23	3.04	2.51	4.26	2.41	2.55	3.39	2.71	1.49	2.12	3.51	2.46	3.46	3.47
601203	1.14	5.95	4.56	4.73	3.66	2.84	2.58	4.12	2.47	2.60	3.27	2.62	1.89	2.64	4.51	3.77	5.21	5.39
605101	1.28	6.29	5.66	7.63	6.32	4.35	3.94	7.68	4.69	4.12	6.40	4.73	1.58	2.08	4.66	2.98	4.05	4.06
605102	1.32	6.86	5.68	8.05	6.66	4.58	4.25	8.12	5.19	4.48	6.77	5.06	1.88	2.48	5.39	3.64	4.63	4.81
605103	0.85	4.71	3.78	5.46	4.11	3.14	2.77	5.32	2.81	2.94	4.50	3.23	1.39	1.91	3.87	2.76	3.43	3.70
605201	2.15	9.90	8.24	11.71	9.22	6.55	9.59	11.78	7.28	6.20	10.04	7.33	2.55	3.26	6.98	4.98	5.89	6.09
605202	1.48	6.84	5.62	7.98	6.88	4.60	4.02	7.75	4.65	4.26	6.47	4.90	2.12	2.94	5.89	4.66	5.77	5.79
605203	1.99	9.38	7.75	10.57	7.50	5.94	5.25	10.25	5.31	5.54	8.54	6.31	2.58	3.65	7.25	5.15	6.87	6.88
605311	1.18	5.46	4.71	6.93	4.91	3.95	3.63	6.70	4.13	3.71	5.77	4.02	1.33	1.68	3.44	2.19	3.05	3.17
605312	1.14	4.99	4.20	6.33	5.01	3.53	3.66	6.16	3.69	3.43	5.24	3.53	1.25	1.72	3.39	2.17	2.96	2.97
605313	1.00	4.69	3.78	5.79	4.56	3.15	2.91	5.64	3.57	3.07	4.79	3.10	1.15	1.53	3.43	2.10	2.79	2.91
605321	0.93	5.04	3.90	6.03	4.71	3.23	2.85	5.86	3.38	2.87	4.93	3.28	1.03	1.41	2.95	1.86	2.54	2.66
605322	0.92	4.88	4.03	5.95	5.10	3.22	2.85	5.76	3.51	2.89	4.78	3.28	1.21	1.56	3.49	2.17	2.95	3.07
605331	0.83	4.29	3.56	5.14	3.45	2.82	2.47	5.01	2.98	2.62	4.08	2.65	0.80	1.17	2.62	1.61	2.05	2.26
605332	0.70	4.01	3.53	4.91	3.56	2.67	2.40	4.78	2.86	2.31	3.97	2.62	0.99	1.37	3.16	2.09	2.41	2.70
605333	1.25	5.89	5.27	7.33	5.12	3.86	3.53	6.92	4.27	3.44	5.66	4.17	1.53	2.10	4.68	3.25	3.81	4.15
606101	1.41	7.11	5.67	5.68	4.30	3.25	3.12	5.17	2.73	3.14	3.89	2.89	1.64	2.40	3.97	3.12	4.50	4.67
606102	2.83	12.12	9.32	10.63	8.24	6.16	5.38	10.03	5.62	5.83	7.36	5.88	3.21	4.33	7.29	5.32	7.66	7.91
606201	1.28	6.41	5.01	5.40	4.51	3.09	2.67	4.73	2.30	2.58	3.17	2.49	1.25	1.89	3.46	2.52	3.73	3.74
606203	1.08	5.57	4.35	4.52	3.43	2.60	2.74	4.23	2.50	2.50	3.20	2.66	1.91	2.69	4.50	3.74	5.61	5.62
606321	1.63	5.62	4.31	5.23	3.97	3.03	3.18	4.96	2.89	3.04	3.66	2.90	1.30	2.48	3.69	2.78	3.71	4.04
606322	1.14	4.50	3.34	4.15	3.20	2.47	2.33	3.84	2.21	2.35	2.78	2.23	1.46	1.85	2.98	2.29	3.02	3.17
606323	1.09	4.27	3.18	3.79	2.75	2.34	2.21	3.48	1.95	2.08	2.62	2.09	1.22	1.71	2.91	2.10	2.64	2.78
607101	0.85	4.22	4.06	5.92	4.27	3.22	2.84	5.51	3.55	3.02	3.89	2.94	1.59	2.32	4.71	3.38	4.83	5.03
607102	0.98	4.82	4.64	5.91	4.51	3.38	3.10	5.76	3.75	3.31	4.11	3.51	1.99	3.02	6.01	4.35	5.93	6.17
607103	0.84	3.95	3.96	5.50	4.16	3.01	2.77	5.13	3.47	2.83	3.64	2.75	1.47	2.26	4.58	3.29	4.52	4.88
607201	0.94	3.98	3.84	5.84	4.35	2.88	2.57	5.29	3.19	2.85	3.61	2.10	1.14	1.82	4.20	2.60	4.07	4.09
607202	0.67	3.44	3.00	4.45	3.33	2.52	2.03	4.00	2.70	2.21	2.87	2.25	1.48	2.31	4.72	3.62	5.61	5.62
607203	0.82	2.99	2.88	3.98	3.01	2.17	1.98	3.50	2.29	1.91	2.41	2.12	1.23	2.34	4.81	3.86	5.68	5.69
607311	1.09	3.40	3.14	6.32	3.84	3.70	3.04	6.58	4.16	3.06	4.18	2.60	1.18	1.76	3.13	2.12	2.81	3.06
607312	1.11	3.71	3.57	6.59	3.74	3.48	3.10	5.99	3.94	3.01	4.26	2.69	1.37	1.88	3.67	2.39	3.37	3.51
607313	0.94	3.77	3.63	6.06	4.58	3.26	3.01	5.50	3.57	2.93	3.88	2.60	1.38	1.89	3.71	2.51	3.53	3.67
607321	1.07	4.65	4.48	6.75	4.86	3.58	3.03	6.09	4.07	3.34	4.25	3.10	1.62	2.18	4.05	2.85	4.95	5.14
607322	0.90	3.64	3.50	5.55	4.11	2.90	2.46	5.18	3.30	2.82	3.72	2.52	1.26	1.78	3.53	2.31	3.22	3.48

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 16

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
607331	1.05	2.88	2.76	5.54	3.93	3.53	3.04	6.17	3.31	2.83	3.45	2.09	0.92	1.46	2.70	1.90	2.33	2.45
607332	1.30	3.74	3.74	6.64	4.28	3.95	3.47	6.92	4.33	3.35	4.53	2.78	1.34	2.13	3.95	2.63	3.57	3.73
607333	1.20	3.80	3.64	6.32	4.35	3.52	2.91	6.15	3.85	2.81	4.26	2.70	1.26	1.92	4.05	2.84	3.66	3.83
608101	1.76	6.61	5.37	12.86	6.63	6.00	5.22	11.64	8.13	5.84	8.98	5.87	1.53	2.45	5.55	2.94	4.37	4.55
608103	1.35	5.70	4.58	10.24	6.29	4.85	4.66	9.07	5.58	4.71	7.75	5.88	1.98	2.82	5.77	3.60	5.23	5.46
608201	1.35	5.86	4.97	10.40	6.42	4.84	4.47	9.52	7.06	5.55	8.05	5.39	1.85	2.78	6.00	3.79	7.44	8.06
608202	0.95	4.78	3.81	8.97	4.84	3.52	3.19	7.82	5.36	3.97	5.63	3.50	1.12	2.00	4.98	3.23	4.55	4.57
608203	1.20	4.80	3.76	7.83	4.86	3.83	3.54	7.20	5.58	4.23	5.86	3.81	1.66	2.50	5.38	4.03	5.32	5.54
608301	1.50	5.06	4.23	9.86	5.10	4.76	4.12	9.52	6.35	4.47	6.84	4.35	1.28	2.00	3.99	2.18	3.40	3.41
608302	1.47	4.95	4.14	9.53	4.98	4.48	4.03	8.85	6.18	4.21	6.65	4.39	1.33	2.03	4.32	2.42	3.29	3.56
608303	1.12	4.38	3.63	8.09	4.25	3.81	3.40	7.29	5.51	3.71	5.93	4.18	1.27	1.88	4.12	2.49	3.50	3.65
609101	0.60	4.14	3.14	6.19	3.71	2.67	2.68	5.61	3.76	3.08	4.90	3.38	0.82	1.30	2.94	1.96	2.55	2.91
610101	0.69	4.41	3.94	4.26	3.28	2.37	2.38	4.15	2.31	2.42	3.35	2.55	1.06	1.40	2.86	1.90	2.83	2.84
610103	0.74	4.43	4.10	4.10	3.31	2.32	2.32	3.77	2.32	2.31	3.01	2.05	1.07	1.42	2.71	1.78	2.56	2.70
610201	1.17	6.10	5.88	5.67	5.29	3.35	3.00	5.30	3.13	3.37	4.32	3.15	1.47	1.89	3.43	2.48	3.59	3.60
610202	0.87	5.18	4.81	4.81	3.25	2.86	2.86	4.67	2.88	2.76	3.72	2.78	1.35	1.87	3.64	2.60	3.69	3.70
610203	1.09	6.68	6.15	5.92	4.27	3.44	3.60	5.73	3.47	3.64	4.52	3.21	1.78	2.42	4.81	3.47	4.89	5.10
610301	0.79	4.73	4.42	4.43	2.85	2.52	2.31	4.16	2.44	2.66	3.38	2.36	1.23	1.51	2.64	1.94	2.81	2.93
610302	0.86	4.57	4.27	4.42	2.84	2.51	2.41	4.30	2.54	2.65	3.50	2.35	1.21	1.59	2.62	1.92	2.78	2.90
610303	0.77	4.53	4.08	4.55	3.43	2.65	2.65	4.43	2.58	2.69	3.62	2.61	1.25	1.58	2.78	1.97	2.85	2.96
611391	0.86	2.81	2.82	6.91	4.37	3.67	4.02	6.96	4.23	3.71	5.01	3.41	0.77	1.29	3.18	1.76	2.65	2.96
611392	1.17	4.01	4.02	9.51	5.46	5.05	5.70	9.94	6.20	5.11	6.97	4.75	1.25	1.83	3.77	2.23	3.71	3.73
613101	0.66	4.52	3.89	3.75	3.34	2.36	2.48	3.78	2.27	2.28	2.87	1.97	1.19	1.59	2.93	2.26	3.23	3.37
613102	0.70	4.23	3.62	3.63	3.23	2.14	2.04	3.69	2.08	2.08	2.68	2.12	1.04	1.55	3.16	2.25	3.65	3.67
613103	0.68	5.11	4.34	4.36	3.86	2.55	2.69	4.24	2.34	2.34	3.17	2.51	1.47	2.07	4.24	3.06	4.51	4.70
613201	0.45	2.68	2.46	2.35	1.94	1.46	1.37	2.36	1.28	1.28	1.75	1.29	0.70	0.95	1.76	1.39	2.06	2.17
613202	0.63	4.07	3.61	3.48	3.08	2.22	2.23	3.54	2.04	2.16	2.66	2.20	1.19	1.82	3.57	2.70	4.43	4.44
613203	0.56	3.49	2.93	2.94	2.26	1.94	1.78	2.98	1.81	1.81	2.31	1.83	0.95	1.55	3.08	2.24	3.90	3.90
613301	0.64	4.04	3.61	3.62	2.85	2.17	2.07	3.50	1.78	2.20	2.54	1.90	1.06	1.34	2.15	1.86	2.52	2.63
613302	0.65	3.91	3.36	3.50	2.88	2.10	2.21	3.41	2.02	2.03	2.47	2.05	1.03	1.41	2.78	1.95	2.74	2.86
613303	0.91	4.52	3.77	3.92	3.00	2.31	2.32	3.81	2.23	2.24	2.82	2.05	1.29	1.69	3.39	2.36	3.21	3.34
614101	1.16	3.77	3.00	3.10	1.79	1.46	1.23	2.50	1.31	1.23	1.79	1.46	0.58	1.01	1.96	1.62	2.14	2.32
614102	0.80	3.21	2.52	2.61	1.89	1.41	1.63	2.30	1.23	1.30	1.76	1.43	0.69	1.02	1.84	1.41	1.78	1.86
614201	0.67	2.97	2.32	2.77	1.97	1.33	1.18	2.20	1.24	1.24	1.61	1.15	0.59	0.84	1.71	1.30	1.74	1.74

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 16

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
614203	1.02	4.94	3.64	4.28	3.28	2.37	2.04	3.70	2.24	2.08	2.79	2.45	1.48	2.15	3.85	3.30	4.14	4.15
614341	1.37	5.06	4.06	5.06	3.44	3.00	2.72	5.22	2.71	2.44	3.26	2.43	1.19	1.89	3.07	2.24	2.61	2.89
614342	1.49	5.06	4.21	5.05	3.73	3.42	3.13	4.85	2.70	2.56	3.39	2.54	1.29	1.75	2.90	2.08	2.58	2.71
614343	1.33	5.18	4.04	5.17	3.02	2.75	2.36	4.65	2.74	2.35	3.27	2.33	1.15	1.59	2.95	2.15	2.78	2.91
616371	1.80	7.04	6.07	9.38	6.82	6.34	6.12	10.49	5.92	4.88	6.89	4.72	1.95	2.71	5.00	3.26	4.15	4.53
616372	1.49	6.31	5.65	7.55	4.50	4.15	3.64	7.35	4.93	3.69	5.99	4.07	1.94	2.54	5.09	3.39	4.45	4.64
616373	0.38	6.59	5.80	9.62	4.06	3.69	3.14	7.38	4.64	3.27	6.13	3.94	1.30	1.99	5.05	3.94	4.69	4.52
616451	1.65	6.53	5.83	8.42	5.64	5.02	4.43	9.07	5.46	4.46	6.61	4.30	1.77	2.51	4.75	3.03	4.25	4.26
616452	1.25	5.40	4.99	6.54	4.61	3.71	4.06	6.34	4.27	3.40	5.06	3.59	1.63	2.21	4.37	2.87	3.72	3.90
616453	1.09	5.74	5.07	6.50	4.48	3.19	2.86	6.08	3.98	2.92	5.01	3.49	1.47	2.09	4.56	3.00	4.12	4.33
617381	1.57	6.06	5.85	7.74	5.26	4.51	4.34	8.61	5.11	4.37	6.15	4.05	1.69	2.11	3.96	2.74	3.23	3.87
617382	1.31	6.74	6.52	7.75	5.07	4.52	4.18	8.34	5.12	4.39	6.17	4.07	1.46	2.14	4.15	2.63	3.58	3.75
617451	1.41	5.73	5.30	7.74	5.33	4.92	4.73	8.99	4.96	4.20	5.84	3.69	1.43	2.01	3.78	2.38	1.86	2.01
617452	1.84	8.32	8.03	9.98	6.73	5.81	5.60	10.81	6.55	6.33	8.17	5.27	2.05	2.83	5.60	3.58	5.10	5.12
617453	0.72	3.73	3.39	4.08	3.09	2.35	2.07	4.12	2.67	2.38	3.47	2.26	0.95	1.35	2.76	1.93	2.68	2.68
618301	1.25	4.26	3.72	7.98	5.07	4.67	3.73	8.30	5.29	3.40	5.52	3.08	1.05	1.73	3.28	1.91	2.36	2.52
618302	1.65	6.06	5.45	10.03	5.09	4.91	3.87	9.12	6.34	4.24	7.27	4.26	1.65	2.32	4.68	2.81	3.44	3.76
618303	1.72	6.87	5.74	9.71	5.15	4.77	3.88	8.80	6.24	4.44	7.45	4.29	2.12	2.71	5.50	3.55	4.44	4.81
618401	1.11	5.72	5.03	7.04	4.85	3.28	2.93	3.87	4.28	3.34	4.73	3.56	1.76	2.42	5.09	3.73	4.99	5.22
619381	1.30	5.22	4.29	5.63	3.96	3.31	3.16	6.09	3.65	3.03	4.17	3.04	1.27	1.67	2.95	1.98	2.70	3.00
619382	1.67	6.39	5.54	6.86	4.26	3.92	3.60	6.67	4.30	3.80	5.23	3.66	1.54	2.09	3.90	2.56	3.64	3.81
619383	1.14	4.48	3.74	4.69	2.77	2.62	2.32	4.35	2.81	2.35	3.49	2.23	1.01	1.43	2.92	1.91	2.69	2.70
619491	1.98	7.24	6.30	8.03	5.49	4.54	4.37	8.09	5.15	4.42	5.99	4.28	1.89	2.61	4.92	3.44	4.66	4.67
619492	0.98	3.80	3.19	3.65	2.49	1.97	1.97	3.36	2.11	1.86	2.79	1.99	1.03	1.51	3.11	2.43	2.86	2.86
619493	1.04	4.75	4.04	4.22	3.40	2.51	2.37	3.90	2.52	2.25	3.43	2.69	1.48	2.01	3.81	3.04	3.85	4.02
620301	1.18	5.07	4.67	6.47	5.33	4.13	3.95	6.78	3.99	4.19	5.00	3.16	1.94	2.73	4.73	3.32	5.04	5.26
620302	2.70	13.94	13.38	17.88	14.09	10.97	10.53	18.12	10.22	11.68	14.44	9.08	5.71	8.06	18.09	11.44	17.15	18.54
620303	1.60	9.28	8.86	11.62	10.28	7.36	7.00	11.80	7.51	7.53	9.23	6.49	4.08	5.92	13.32	8.91	13.64	14.18
620441	0.79	3.34	3.04	3.83	3.21	2.48	2.49	4.19	2.50	2.37	3.40	2.39	1.24	1.75	3.46	2.46	3.36	3.52
620442	0.92	5.00	4.60	6.36	4.85	3.73	3.57	6.69	3.97	3.81	4.97	4.04	1.98	3.09	6.44	4.24	6.35	6.60
620443	0.89	4.21	3.96	5.03	4.00	3.03	3.28	5.38	3.33	3.34	4.37	3.15	1.78	2.74	5.88	5.39	6.02	6.03
622311	0.65	3.84	3.31	3.44	2.60	2.07	1.78	3.23	1.71	1.81	2.23	1.55	0.86	1.14	2.01	1.57	2.19	2.20
622312	0.91	4.44	3.78	3.78	3.03	2.33	2.07	3.66	1.96	1.97	2.66	1.99	1.14	1.65	3.02	2.36	2.95	2.96
622313	1.22	6.57	5.58	5.59	4.71	3.35	3.18	5.17	3.38	3.21	3.96	2.89	1.93	2.75	5.29	3.88	5.59	5.59
622381	1.06	5.85	5.04	5.05	4.15	3.17	2.87	4.90	2.75	2.91	3.54	2.35	1.44	1.98	3.31	2.46	3.54	3.55

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 16

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
622382	1.00	5.06	4.18	4.36	3.55	2.67	2.40	4.20	2.54	2.55	2.97	2.28	1.28	1.66	3.01	2.06	2.90	3.04
622383	1.17	5.96	4.96	4.97	4.09	3.14	2.84	5.02	2.73	2.73	3.51	2.76	1.44	2.11	3.76	2.59	3.68	3.69
622411	0.99	5.27	4.69	4.88	4.04	2.84	2.51	4.56	2.54	2.65	3.26	2.46	1.36	1.72	2.98	2.45	3.28	3.42
622412	1.11	5.03	4.05	4.24	3.51	2.84	2.37	4.04	2.37	2.37	2.83	2.21	1.22	1.63	2.82	2.50	3.14	3.14
622413	1.05	5.00	4.38	4.38	3.43	2.58	2.26	4.20	2.43	2.43	2.94	2.29	1.11	1.69	2.81	2.18	2.84	3.02
622451	0.68	3.97	3.30	3.46	2.83	2.09	1.82	3.29	2.09	2.09	2.37	1.54	1.03	1.41	2.21	1.66	2.35	2.35
622452	0.81	3.81	3.15	3.31	2.69	1.98	2.12	3.16	2.41	1.98	2.26	1.71	0.95	1.20	2.14	1.60	2.29	2.29
622453	0.83	5.00	4.24	4.25	3.40	2.62	2.33	4.27	2.20	2.20	2.95	2.36	1.28	1.69	3.16	2.28	3.20	3.21
623101	1.69	4.33	3.42	4.34	3.32	2.78	2.04	4.07	2.14	2.14	2.70	2.33	1.52	1.84	2.45	1.86	2.58	2.68
623102	1.36	3.99	3.04	3.90	2.94	2.43	1.81	3.53	1.82	1.83	2.27	2.01	1.30	1.62	2.23	1.74	2.46	2.46
623301	1.77	4.16	3.62	4.31	3.26	2.92	2.13	3.90	2.23	2.14	2.73	2.43	1.64	2.07	2.86	2.27	2.86	2.99
623302	1.77	4.33	3.66	4.33	3.31	2.77	2.21	4.06	2.13	2.13	2.69	2.40	1.57	1.89	2.42	1.99	2.63	2.73
623303	2.38	5.60	4.67	5.81	4.51	3.78	2.92	5.22	2.93	2.93	3.66	3.17	2.04	2.53	3.56	2.65	3.58	3.71
623381	2.68	5.94	4.83	6.15	4.67	4.02	2.99	5.58	2.86	3.00	3.59	3.16	2.09	2.49	3.34	2.40	3.38	3.53
623382	2.75	6.35	4.99	6.36	5.00	4.14	3.22	5.97	3.08	3.23	3.85	3.39	2.02	2.56	3.59	2.60	3.63	3.63
623451	2.38	5.11	4.11	5.29	4.12	3.37	2.54	4.79	2.55	2.69	3.11	2.70	1.70	2.08	2.74	1.99	2.78	2.78
623452	1.64	3.52	3.05	3.51	2.60	2.31	1.77	3.35	1.76	1.76	2.30	1.89	1.25	1.62	2.15	1.48	2.01	2.14
623453	2.62	6.37	5.33	6.38	4.77	4.06	3.41	5.76	2.96	3.12	3.92	3.44	2.27	2.85	3.81	2.89	3.85	4.02
623454	1.97	4.89	4.15	4.70	3.64	3.16	2.40	4.34	2.41	2.41	3.01	2.70	1.85	2.27	3.18	2.42	3.19	3.35
624101	1.80	4.28	3.49	4.43	3.38	2.83	2.53	4.16	2.18	2.27	2.75	2.37	1.46	1.78	2.40	1.81	2.62	2.62
624102	1.97	5.08	3.83	4.90	3.84	3.10	2.46	4.43	2.37	2.47	3.00	2.58	1.93	1.94	2.71	1.97	2.84	2.95
624342	1.75	4.12	3.53	4.26	3.36	2.81	2.05	3.91	2.14	2.26	2.63	2.23	1.62	1.83	2.54	2.13	2.73	2.72
624343	2.65	6.30	5.36	6.29	5.00	4.19	3.44	5.89	3.02	3.29	4.01	3.28	2.22	2.72	3.98	2.96	3.95	4.10
624451	1.83	4.52	3.64	4.70	3.48	3.00	2.40	4.34	2.26	2.26	2.85	2.56	1.58	1.99	2.72	2.00	2.73	2.73
624452	1.52	4.02	3.21	3.86	3.06	2.47	2.06	3.54	1.93	1.93	2.48	2.20	1.54	1.94	2.49	1.95	2.65	2.65
624453	1.30	3.63	3.30	3.30	2.99	2.39	2.25	3.15	1.69	1.69	2.10	1.97	1.43	1.83	2.39	1.97	2.54	2.54
625301	1.78	5.36	4.47	6.01	4.83	3.90	2.80	5.61	3.16	2.82	3.42	2.85	1.89	2.67	3.88	2.82	3.55	3.81
625302	1.34	4.43	3.61	4.59	3.27	2.84	2.17	4.31	2.46	2.19	2.66	2.29	1.55	2.13	3.34	2.43	3.05	3.16
625303	1.37	4.31	3.75	4.63	2.92	2.93	2.23	4.18	2.43	2.15	2.63	2.44	1.65	2.26	3.56	2.68	3.23	3.23
626121	1.31	4.90	3.72	4.29	3.19	2.52	2.21	3.92	2.37	2.38	2.70	2.23	1.49	1.93	2.89	2.58	3.09	3.09
626122	1.01	4.15	3.08	3.61	2.45	2.00	1.86	3.11	1.59	1.73	2.33	1.74	0.93	1.48	2.22	1.79	2.55	2.56
626123	1.03	4.43	3.32	3.87	2.67	2.06	1.62	3.36	1.79	1.79	2.40	1.81	1.13	1.56	2.47	1.89	2.68	2.85
626311	0.77	2.82	2.08	2.56	1.83	1.48	1.37	1.70	1.24	1.35	1.67	1.33	0.89	1.20	1.73	1.49	1.81	1.92
626312	1.68	6.67	5.27	5.84	4.40	3.45	3.31	5.29	3.03	3.17	3.93	3.18	1.97	2.77	4.46	3.22	4.48	4.66
626313	1.65	7.02	4.99	6.07	4.42	3.53	3.20	5.44	3.23	3.40	4.11	3.42	2.19	2.97	4.94	3.68	5.00	5.21

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 16

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
626321	1.16	4.88	3.82	4.25	3.12	2.36	2.24	3.79	2.10	2.10	2.70	2.20	1.29	1.83	3.03	2.50	3.12	3.11
626322	1.54	6.20	4.78	5.46	3.99	3.13	3.00	4.77	2.86	2.86	3.68	2.98	1.85	2.58	3.95	3.23	4.24	4.24
626323	0.83	3.52	2.66	2.94	2.26	1.76	1.63	2.65	1.51	1.51	2.00	1.63	1.04	1.38	2.24	1.73	2.36	2.36
626351	0.81	3.83	2.92	3.43	2.37	1.85	1.76	2.97	1.69	1.69	2.10	1.62	0.92	1.28	1.97	1.52	2.24	2.35
626352	1.25	4.91	3.73	4.22	3.14	2.31	2.32	3.78	2.21	2.22	2.64	2.25	1.39	1.90	3.30	2.63	4.15	4.16
626353	1.19	4.79	3.79	4.18	3.08	2.41	2.26	3.63	2.11	2.12	2.60	2.13	1.39	1.99	2.98	2.50	3.18	3.36
626371	1.18	4.33	3.47	3.81	3.00	2.69	2.12	3.48	1.98	2.12	2.55	1.85	1.20	1.72	2.42	1.86	2.73	2.73
626372	1.22	5.00	3.82	4.15	3.08	2.39	2.00	3.70	2.28	2.16	2.70	2.31	1.45	1.95	2.91	2.26	3.11	3.26
626373	1.42	6.61	4.96	5.55	3.92	3.13	2.54	4.82	2.71	2.86	3.65	3.04	1.93	2.64	4.23	3.14	4.47	4.66
626381	1.32	5.08	3.90	4.39	3.75	2.73	2.20	4.08	2.47	2.34	2.89	2.49	1.49	1.98	2.93	2.27	3.10	3.24
626382	1.29	5.82	4.45	4.82	3.60	2.81	2.38	4.28	2.53	2.68	3.29	2.68	1.72	2.26	3.48	2.57	3.82	4.00
626383	1.16	4.87	3.83	4.18	2.92	2.36	2.23	3.72	2.12	2.13	2.69	2.29	1.40	1.93	3.07	2.39	3.14	3.44
626391	1.24	4.72	3.56	4.04	2.98	2.42	2.29	3.75	2.05	2.19	2.60	2.08	1.34	1.60	2.40	1.91	2.73	2.88
626392	1.01	4.96	3.76	4.09	3.00	2.30	2.04	3.63	2.05	2.19	2.75	2.07	1.32	1.70	2.94	2.12	2.98	3.13
626393	1.05	4.28	3.27	3.60	2.82	2.11	1.97	2.98	1.85	1.85	2.41	1.86	1.10	1.62	2.59	2.04	2.77	2.77
626411	1.18	5.25	3.76	4.53	3.38	2.58	2.18	4.10	2.20	2.30	2.84	2.14	1.45	1.99	2.81	2.23	3.10	3.34
626412	1.59	6.28	4.49	5.34	3.73	2.85	2.52	4.71	2.70	2.70	3.38	2.71	1.63	2.24	3.59	2.90	3.61	3.80
626413	1.15	4.41	3.30	3.84	2.64	2.17	1.73	3.32	1.88	1.89	2.34	1.75	1.06	1.62	2.53	1.93	2.71	2.71
626421	1.27	5.15	3.78	4.34	2.93	2.46	2.01	3.80	2.17	2.17	2.80	2.18	1.33	1.90	2.84	2.38	3.03	3.04
626422	1.16	4.83	3.67	4.24	2.99	2.51	1.90	3.70	2.07	2.07	2.54	1.94	1.24	1.67	2.59	2.00	2.96	2.97
626423	1.25	5.05	4.07	4.26	3.20	2.41	1.96	3.73	2.12	2.12	2.73	1.98	1.29	1.85	2.92	2.31	3.10	3.11
626431	1.08	4.81	3.39	4.26	3.57	2.63	1.91	3.76	1.93	2.08	2.52	2.10	1.05	1.58	2.58	2.03	2.93	3.09
626432	0.86	3.53	2.70	3.02	2.39	1.81	1.53	2.87	1.53	1.53	1.96	1.40	1.00	1.27	2.12	1.55	2.13	2.28
626433	1.33	5.96	4.62	4.99	3.64	2.89	2.47	4.32	2.50	2.64	3.24	2.53	1.63	2.16	3.32	2.49	3.54	3.70
626441	1.04	4.44	3.26	3.59	2.65	2.22	1.82	3.27	1.82	1.95	2.37	1.96	1.18	1.57	2.39	1.84	2.54	2.69
626442	0.84	3.84	2.95	3.10	2.16	1.79	1.55	2.69	1.55	1.55	1.92	1.56	0.99	1.34	1.95	1.47	2.09	2.22
626443	1.63	6.83	6.39	5.77	4.14	3.35	2.76	5.04	3.08	3.09	3.87	3.12	2.03	2.59	3.97	3.08	4.21	4.38
626451	1.44	5.93	4.53	5.11	3.66	3.18	2.57	4.74	2.58	2.73	3.36	2.60	1.63	2.32	3.08	2.50	3.43	3.60
626452	1.80	7.32	5.33	6.39	4.59	3.74	3.58	5.77	3.28	3.44	4.11	3.30	2.02	2.73	4.00	3.07	4.39	4.75
626453	1.72	7.36	5.53	6.18	4.95	3.87	3.22	5.78	3.24	3.24	4.08	3.43	2.10	2.99	4.51	3.36	4.76	4.95
626461	1.52	6.27	4.69	5.26	3.85	3.07	2.64	4.91	2.80	2.81	3.58	2.83	1.75	2.44	3.49	2.63	3.87	4.04
626462	1.40	5.85	3.99	4.88	3.68	2.78	2.36	4.37	2.66	2.66	3.27	2.69	1.63	2.30	3.49	2.63	3.71	3.87
626463	0.69	3.58	2.77	3.03	2.27	1.79	1.45	2.52	1.46	1.46	1.92	1.58	0.93	1.48	2.30	1.72	2.45	2.45
626481	0.86	3.32	2.54	2.92	2.16	1.70	1.58	2.51	1.46	1.57	1.90	1.55	0.90	1.31	2.21	1.84	2.42	2.41
626482	0.90	4.30	3.32	3.64	2.58	2.03	2.03	3.97	1.90	1.90	2.45	2.04	1.27	2.04	3.19	2.32	3.20	3.35

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 16

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
626483	1.54	5.62	4.20	4.70	3.56	2.83	2.83	4.19	2.55	2.69	3.26	2.96	2.02	2.96	4.51	3.85	4.85	4.85
626711	1.11	6.19	4.16	4.93	3.17	2.27	2.42	4.23	2.03	2.46	3.09	1.93	1.28	1.98	3.05	2.49	3.62	3.80
626712	1.44	6.17	4.24	5.27	3.88	2.52	2.84	4.67	2.70	2.71	3.22	1.96	1.54	2.14	3.45	2.81	3.69	3.87
626731	1.25	5.05	3.72	4.27	3.21	2.73	2.12	3.92	1.99	2.14	2.75	2.15	1.31	1.73	2.64	2.20	2.98	3.15
626732	0.88	3.96	2.92	3.43	2.77	2.15	1.72	3.11	1.73	1.73	2.18	1.60	0.93	1.34	2.22	1.79	2.40	2.40
626733	1.36	5.66	4.21	4.56	3.43	2.71	2.30	4.42	2.33	2.47	3.04	2.49	1.61	2.00	3.13	2.33	3.64	3.50
626734	1.62	5.57	4.52	4.69	3.46	2.77	2.51	4.23	2.52	2.66	3.07	2.54	1.57	2.05	2.84	2.34	3.15	3.29
626812	1.17	4.50	3.73	4.11	2.86	2.38	2.07	3.57	2.08	2.08	2.56	2.10	1.23	1.67	2.60	1.99	2.80	2.80
626813	0.60	3.68	2.62	3.14	2.15	1.70	1.41	2.66	1.43	1.43	1.74	1.03	0.13	1.20	1.81	1.54	2.17	2.18
626831	1.40	5.80	4.43	4.87	3.64	2.91	2.40	4.26	2.42	2.43	3.13	2.45	1.51	2.15	3.21	2.53	3.45	3.64
626832	0.91	4.73	3.75	3.75	2.72	2.10	1.81	3.43	1.83	1.99	2.62	2.16	1.31	1.90	3.20	2.57	3.44	3.45
717391	1.13	3.95	3.00	3.31	2.70	2.01	1.49	2.28	1.36	1.24	1.61	1.48	1.23	1.35	1.47	1.34	1.71	1.84
717392	0.83	3.82	2.66	2.80	2.00	1.51	1.16	2.00	1.16	1.16	1.39	1.27	0.93	1.27	1.38	1.26	1.61	1.73
717393	0.86	3.67	2.63	2.76	2.34	1.56	1.20	1.94	1.07	1.19	1.43	1.30	1.06	1.17	1.52	1.39	1.63	1.63

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 18

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
801301	0.66	4.30	3.36	2.64	1.37	1.50	1.27	2.41	1.53	1.53	1.79	1.68	1.57	1.83	2.37	1.88	3.26	3.71
801302	0.65	3.85	3.23	2.38	1.74	1.37	1.02	2.13	1.38	1.27	1.51	1.40	1.28	1.66	2.32	1.81	3.19	3.64
801303	0.37	3.21	2.27	1.83	1.43	1.17	0.79	1.59	1.19	0.94	1.21	1.09	1.10	1.38	2.10	1.56	2.76	3.24
801491	0.75	4.36	3.49	2.55	2.14	1.47	1.10	2.33	1.66	1.28	1.57	1.59	1.35	1.92	2.84	2.17	3.91	4.27
801492	0.55	2.72	2.16	1.64	1.15	0.68	0.68	1.28	0.92	0.81	0.93	0.70	1.05	1.42	2.21	1.95	2.94	3.24
801493	0.78	4.43	3.60	2.85	2.04	1.66	1.41	2.19	1.43	1.31	1.57	1.83	1.97	2.80	3.88	3.43	4.95	5.33
802301	0.68	6.20	4.46	2.87	1.64	1.30	0.98	1.64	0.87	1.19	1.51	1.74	1.28	1.62	1.49	1.60	1.94	1.82
802302	1.54	10.06	6.87	4.37	2.98	1.91	1.79	2.57	1.91	2.17	2.43	2.98	2.57	3.13	3.13	3.27	3.88	3.88
802303	0.95	5.73	4.47	2.67	1.77	1.06	0.84	1.41	1.06	1.06	1.41	1.77	1.41	1.89	1.77	2.01	2.27	2.27
802491	0.52	4.20	2.98	1.54	1.30	0.73	0.62	0.84	0.61	0.72	0.83	1.06	0.83	1.17	2.01	1.88	1.87	1.87
802492	0.69	4.57	3.21	2.03	1.78	1.08	0.86	1.07	1.06	1.17	1.50	1.38	1.48	1.70	2.17	2.28	2.64	2.50
802493	0.96	6.28	4.62	2.76	2.04	1.51	1.00	1.26	1.27	1.27	1.41	2.10	2.11	2.85	3.51	3.87	4.43	4.62
804343	1.05	6.63	4.74	3.47	2.24	1.16	1.05	1.74	1.16	1.39	1.51	1.86	1.99	3.77	2.63	2.90	4.08	4.08
804411	0.60	3.59	2.74	2.08	1.34	0.78	0.67	1.21	0.98	0.97	1.08	1.18	1.29	1.87	1.36	1.34	2.05	1.92
804412	0.61	4.24	3.32	2.62	1.50	0.93	0.82	1.38	1.03	0.92	1.37	1.60	1.37	2.34	1.60	1.47	2.20	2.07
804413	0.59	4.31	3.39	2.30	1.55	0.98	1.08	1.19	0.84	1.06	1.39	1.61	1.60	2.46	2.30	2.28	3.06	3.05
805201	0.99	4.08	2.97	2.01	1.30	0.62	0.62	1.02	1.10	1.39	1.04	1.26	1.33	1.73	2.08	1.92	3.08	3.19
805202	0.76	6.17	4.50	3.17	2.05	1.17	1.02	1.51	1.44	1.79	1.53	1.81	2.20	2.75	3.39	3.03	5.39	5.40
805203	1.90	7.25	5.50	3.91	2.51	1.75	1.11	1.68	1.50	1.80	1.72	2.15	2.50	3.30	3.79	3.82	6.88	7.22
805341	0.51	2.07	1.59	1.27	0.76	0.44	0.39	0.69	0.68	0.74	0.52	0.67	0.77	0.93	1.33	1.07	1.89	1.89
805343	0.90	3.50	2.80	1.90	1.43	0.87	0.76	0.86	1.06	0.95	0.94	1.04	1.14	1.47	1.92	1.66	3.05	3.05
805411	0.91	3.40	2.70	1.93	1.33	0.77	0.77	1.09	1.08	1.18	0.95	1.17	1.27	1.61	2.07	1.68	2.95	2.95
805412	1.47	5.83	4.52	3.09	1.86	1.25	1.13	1.38	1.50	1.63	1.76	1.64	1.90	2.57	3.16	2.88	4.62	4.63
805413	1.21	4.97	3.79	2.47	1.45	0.98	0.76	0.98	0.99	0.99	0.99	1.22	1.46	1.96	2.77	2.23	4.14	4.14
806201	1.00	5.94	4.70	3.19	1.99	1.54	1.06	1.92	1.40	1.67	1.68	1.70	1.89	2.40	2.99	2.58	3.83	3.84
806202	0.99	6.18	4.51	3.58	1.88	1.53	1.04	1.91	1.22	1.65	1.58	1.76	2.06	2.59	3.08	2.98	4.08	4.09
806203	0.66	4.37	3.08	2.01	1.30	0.88	0.75	1.24	0.89	1.03	1.04	1.26	1.33	1.73	2.17	2.01	3.19	3.19
806301	0.28	4.47	3.18	2.29	1.32	0.66	0.60	1.27	0.90	1.06	1.07	1.08	1.25	1.51	1.98	1.58	2.33	2.44
806302	0.71	4.48	3.31	2.48	1.40	1.06	1.06	1.42	1.07	1.28	1.36	1.29	1.37	1.76	2.10	1.86	2.58	2.58
806303	0.79	4.68	3.81	2.66	1.60	0.95	0.95	1.53	1.10	1.32	1.32	1.40	1.48	1.89	2.26	1.76	2.67	2.77
806491	0.66	3.91	2.93	2.14	1.02	0.80	0.57	1.04	0.81	0.81	0.93	0.94	1.06	1.43	2.62	2.09	2.79	2.66
806492	0.82	6.62	3.61	2.23	1.61	1.14	1.25	1.60	1.25	1.48	1.47	1.59	1.95	2.32	3.42	3.26	4.17	4.00
806493	0.62	4.03	3.12	2.15	1.53	0.83	0.83	1.28	0.93	1.04	1.04	1.39	1.50	1.87	2.51	2.92	3.96	3.96
807201	0.81	3.90	3.16	2.15	1.49	0.78	0.66	1.43	0.74	0.94	1.02	1.17	1.04	1.27	1.44	1.46	3.22	3.34
807202	0.92	4.47	3.68	2.52	1.76	1.11	0.91	1.68	1.11	1.17	1.24	1.45	1.52	1.99	1.90	2.24	3.66	3.54

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 18

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
807203	0.87	4.33	3.09	2.13	1.37	1.04	0.57	1.15	0.77	0.94	1.13	1.40	1.52	2.14	2.10	2.25	4.08	3.94
807301	1.08	4.80	3.63	2.93	1.81	1.41	1.57	1.82	1.00	1.29	1.45	1.38	1.31	1.79	1.74	1.76	3.92	3.93
807302	1.47	6.41	4.74	3.81	2.71	1.75	1.50	2.73	1.52	1.86	2.05	2.06	2.07	2.67	2.39	2.51	5.25	5.26
807303	0.82	4.41	2.98	2.56	1.66	1.42	0.91	1.67	0.93	1.14	1.22	1.30	1.24	1.63	1.57	1.75	3.33	3.34
807491	0.60	3.17	2.48	1.84	1.25	0.80	0.69	1.12	0.68	0.89	1.00	0.99	0.88	1.32	1.54	1.89	2.93	2.92
807492	0.78	3.14	2.36	1.64	1.08	0.87	0.66	1.18	0.75	0.75	0.85	0.74	0.94	1.26	1.69	1.92	2.91	2.91
807493	1.35	5.71	4.22	3.11	2.96	1.47	1.47	2.11	1.59	1.72	1.84	2.10	2.24	2.94	3.23	3.54	5.88	5.67
808201	0.80	6.07	4.58	2.59	1.69	1.26	0.65	1.20	1.06	1.31	1.41	1.42	1.53	2.01	2.16	1.90	2.99	3.24
808202	0.59	4.73	3.61	2.33	1.27	0.86	0.67	1.00	0.94	1.08	1.08	1.30	1.30	1.69	1.78	1.64	2.41	2.42
808203	0.53	4.14	2.82	1.66	1.08	0.75	0.63	0.82	0.77	0.90	0.91	1.05	1.13	1.35	1.52	1.39	2.03	2.12
808301	0.95	6.34	4.40	2.26	1.69	1.02	0.87	1.37	1.22	1.48	1.32	1.42	1.61	2.11	2.25	2.00	2.99	3.24
808302	0.92	6.19	4.70	3.32	1.71	1.29	0.90	1.31	1.24	1.41	1.43	1.44	1.62	2.10	2.34	1.89	2.95	3.19
808303	0.86	6.41	4.92	2.93	1.83	1.50	0.96	1.51	1.43	1.52	1.53	1.70	1.80	2.17	2.59	2.03	3.19	3.43
808461	0.80	5.65	3.67	2.20	1.56	0.85	0.74	1.10	1.00	1.24	1.13	1.27	1.40	1.55	1.96	1.74	2.99	3.15
808462	0.64	5.26	3.29	2.06	1.33	1.10	0.88	1.11	1.00	1.23	1.24	1.24	1.49	1.61	1.87	1.64	2.68	2.82
808463	0.36	3.39	2.46	1.37	0.88	0.41	0.41	0.54	0.55	0.56	0.57	0.82	0.83	1.10	1.38	1.03	1.70	1.98
808491	0.34	3.82	2.74	0.0	0.82	0.49	0.27	0.50	0.62	0.74	0.75	0.64	0.77	1.13	1.52	1.18	2.08	2.36
808492	0.63	4.71	3.42	2.43	1.54	0.74	0.85	1.07	1.07	1.31	1.31	1.19	1.54	1.79	2.30	1.91	2.98	2.98
808493	1.00	6.91	4.52	3.70	1.86	1.02	1.13	1.50	1.38	1.51	1.64	1.77	2.03	2.43	3.46	2.88	4.12	4.29
809201	0.78	6.39	4.63	3.13	1.74	0.91	0.84	1.33	1.18	1.43	1.36	1.55	1.74	2.24	2.28	2.11	3.25	3.51
809202	0.74	6.27	4.51	3.01	1.62	1.03	0.81	1.14	1.07	1.24	1.26	1.45	1.64	2.05	2.19	2.03	3.56	3.71
809203	0.50	4.68	3.39	1.85	1.21	0.86	0.73	0.94	0.88	0.95	1.03	1.18	1.27	1.59	1.69	1.63	2.54	2.65
809301	0.50	4.69	3.40	2.32	1.22	0.87	0.61	0.95	0.90	1.11	0.98	1.06	1.21	1.54	1.64	1.51	2.21	2.40
809302	0.65	4.93	3.82	2.11	1.51	0.84	0.57	1.00	0.80	1.02	0.89	1.04	1.20	1.53	1.56	1.43	2.14	2.33
809303	0.76	6.04	5.21	2.70	1.94	1.21	0.92	1.37	1.30	1.46	1.38	1.63	1.72	2.08	2.67	1.84	2.81	3.03
809411	0.50	3.71	3.27	2.07	0.91	0.69	0.59	0.79	0.79	0.90	1.00	1.00	1.00	1.33	1.55	1.31	2.14	2.26
809412	0.57	4.57	2.93	1.82	1.57	0.84	0.50	0.97	0.98	0.98	0.99	1.24	1.25	1.64	1.93	1.56	2.66	2.81
810301	0.73	3.86	3.07	2.32	1.60	1.12	0.99	2.08	1.13	1.33	1.55	1.55	1.48	2.02	1.87	1.65	2.56	2.65
810302	0.75	3.29	2.58	1.97	1.36	1.16	0.89	1.66	0.97	1.10	1.24	1.31	1.32	1.85	1.78	1.57	2.21	2.30
810303	2.01	3.57	2.63	2.18	1.48	1.21	0.95	1.79	1.15	1.22	1.36	1.58	1.51	1.90	2.16	2.08	2.71	2.81
810321	0.46	4.04	1.84	1.38	1.13	0.72	0.65	1.32	0.74	0.83	1.00	0.92	1.10	1.55	1.67	1.50	2.09	2.30
810322	0.35	2.43	1.65	1.29	1.06	0.72	0.62	1.09	0.64	0.65	1.00	1.13	1.14	1.53	2.20	2.09	2.53	2.54
810323	0.46	3.35	2.33	1.94	1.44	1.08	0.85	1.47	1.00	1.12	1.38	1.64	1.65	2.32	3.22	3.10	3.75	3.76
810431	1.09	4.36	3.64	2.97	2.05	1.63	1.23	2.50	1.49	1.49	2.05	2.05	1.77	2.50	2.50	2.35	3.13	3.30
810432	0.62	3.42	2.43	1.84	1.42	1.15	0.89	1.71	0.90	1.16	1.30	1.17	1.31	1.88	2.03	1.90	2.67	2.83

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 18

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
811311	0.66	4.07	3.08	2.31	1.37	0.83	0.72	1.02	0.91	0.90	1.00	1.20	1.08	1.40	1.26	1.34	1.77	1.65
811312	0.84	5.10	3.88	2.87	1.91	1.26	1.09	1.35	1.18	1.18	1.36	1.63	1.45	1.73	1.73	1.64	2.03	2.03
811313	0.88	5.76	4.13	3.08	2.00	1.09	1.02	1.40	1.17	1.32	1.40	1.73	1.64	1.98	1.89	1.88	2.52	2.52
811471	0.70	4.26	3.22	2.34	1.82	0.77	0.77	1.05	0.76	0.90	1.05	1.19	1.19	1.57	1.49	1.41	1.81	1.72
811472	1.04	6.13	3.73	2.88	1.98	1.51	1.17	1.51	1.29	1.40	1.64	2.00	2.13	2.64	2.65	2.93	3.64	3.65
812311	1.41	2.80	2.67	4.64	3.23	2.80	2.53	5.17	2.53	2.40	2.94	2.40	1.89	2.53	3.37	2.53	3.08	3.08
812312	1.20	2.57	2.70	4.21	3.22	2.72	2.15	4.56	2.28	2.18	2.64	2.20	1.69	2.34	3.21	2.62	3.13	3.27
812313	1.15	2.58	2.36	4.02	3.07	2.59	2.25	4.34	2.37	2.15	2.72	2.26	1.95	2.73	3.63	2.86	3.50	3.64
812411	1.00	2.38	2.26	3.89	2.89	2.37	1.99	4.02	2.22	2.10	2.47	2.33	1.96	2.83	3.51	2.93	3.47	3.61
812412	1.02	2.31	2.16	3.12	2.65	2.20	1.62	2.84	1.94	1.80	2.25	2.27	2.59	3.77	5.15	5.39	6.57	6.58
813311	0.91	2.55	2.29	3.80	2.67	2.41	1.91	4.73	2.14	2.02	2.39	1.88	1.64	2.37	2.74	2.21	2.72	2.85
813312	1.13	2.97	2.63	4.37	3.44	2.86	2.64	5.50	2.54	2.33	2.98	2.44	2.14	3.10	3.85	2.89	3.61	3.74
813313	0.97	2.44	6.68	3.55	2.80	2.35	2.24	4.28	2.36	2.05	2.48	2.16	2.07	3.09	3.90	3.12	3.80	3.94
813471	0.78	1.96	1.76	2.94	2.28	1.98	1.69	3.86	1.80	1.61	2.11	1.82	1.54	2.34	2.80	2.38	2.20	2.30
813473	1.06	2.95	2.41	2.95	2.28	1.90	1.78	3.24	1.78	1.90	2.42	2.55	2.96	4.49	5.75	5.95	6.57	6.79
814311	0.90	6.44	5.07	2.97	1.91	1.26	1.06	1.46	1.24	1.33	1.53	1.74	1.94	2.15	1.78	1.98	1.95	1.94
814312	0.79	4.73	3.88	2.48	1.62	1.19	0.87	1.19	0.87	1.03	1.11	1.36	1.28	1.62	1.45	1.45	1.80	1.89
814313	0.96	6.03	0.0	3.33	2.10	1.17	1.09	1.48	1.31	1.39	1.55	1.89	1.79	2.15	2.13	2.12	3.23	3.23
814471	0.61	4.33	3.32	1.89	1.20	0.81	0.59	0.96	0.80	0.88	1.02	1.26	1.17	1.50	1.48	1.39	1.90	1.90
814472	0.67	3.50	2.96	1.39	1.17	0.64	0.64	0.84	0.73	0.73	0.82	1.13	1.23	1.55	1.65	1.98	2.32	2.32
815341	1.28	3.00	2.75	4.46	3.24	2.69	2.58	5.24	2.38	2.25	2.79	1.98	1.73	2.38	3.08	2.51	3.53	3.53
815343	0.67	1.88	1.64	2.88	2.10	1.85	1.72	3.54	2.83	1.58	1.92	1.56	1.20	1.76	2.34	1.82	2.27	2.26
815411	0.97	2.32	2.19	3.46	2.86	2.31	1.79	4.24	2.04	1.91	2.30	2.03	1.77	2.42	3.11	2.54	3.09	3.09
815412	0.84	2.18	2.04	3.11	2.49	2.20	1.78	3.62	2.21	1.79	2.22	2.23	2.24	3.32	4.57	4.03	4.79	4.80
816341	0.72	5.37	3.84	2.33	2.04	1.35	0.92	1.45	1.10	1.22	1.33	1.57	1.45	1.81	1.69	1.93	2.85	2.71
816342	0.93	5.19	3.79	2.47	1.41	1.08	1.07	1.27	0.94	1.14	1.34	1.43	1.30	1.72	1.67	1.64	2.17	2.16
816343	0.45	3.72	2.52	1.79	1.12	0.70	0.59	0.89	0.67	0.76	0.85	1.05	0.93	1.12	1.19	1.27	1.56	1.55
816411	0.79	5.38	3.80	2.83	1.60	0.93	0.95	1.37	1.03	1.14	1.26	1.49	1.37	1.73	1.61	1.98	2.92	2.64

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 20

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
612111	1.34	6.04	4.33	5.32	4.04	2.92	2.54	4.67	2.68	2.68	3.49	2.82	1.51	2.10	3.40	2.62	3.71	3.86
612113	1.17	5.28	3.64	4.42	3.21	2.40	2.14	3.81	2.03	2.16	2.68	2.04	1.33	1.81	2.99	2.46	3.44	3.44
612121	1.18	5.68	3.85	4.76	3.62	2.77	2.57	4.37	2.58	2.58	3.31	2.69	1.71	2.33	3.92	3.04	4.45	4.45
612122	1.07	4.49	2.69	3.58	2.69	2.01	1.93	3.12	1.83	1.83	2.39	2.01	1.24	1.75	2.91	2.30	3.03	3.03
612123	1.01	3.82	2.82	3.35	2.61	1.96	1.70	3.01	1.78	1.78	2.21	1.85	1.19	1.67	2.56	2.08	2.64	2.74
612131	1.03	4.90	3.44	3.88	2.73	2.27	2.10	3.43	2.01	2.09	2.62	2.17	1.51	2.07	3.40	2.78	3.83	3.94
612133	0.99	4.76	3.25	3.95	2.91	2.27	2.08	3.57	2.01	1.93	2.64	2.05	1.37	2.00	3.33	2.67	3.41	3.54
612142	0.81	3.94	3.34	3.22	2.29	1.75	1.49	2.78	1.65	1.56	2.09	1.64	0.99	1.38	2.34	1.78	2.41	2.51
612143	0.73	3.80	2.89	3.09	2.18	1.72	1.55	2.65	1.53	1.53	2.04	1.59	1.02	1.40	2.46	1.78	2.41	2.51
612151	0.89	4.66	3.21	3.75	2.97	2.17	2.06	3.49	2.08	1.97	2.52	2.09	1.22	1.70	2.80	2.14	2.95	3.08
612152	1.10	5.60	4.04	4.52	3.34	2.47	2.36	4.07	2.37	2.27	2.98	2.63	1.56	2.19	3.56	2.57	3.61	3.75
612153	0.94	4.96	3.82	3.97	2.88	2.17	2.07	3.42	1.98	1.98	2.56	2.22	1.31	1.92	2.98	2.41	3.16	3.30
612212	0.56	3.60	2.56	3.00	2.17	1.66	1.41	2.46	1.31	1.19	1.57	1.33	0.99	1.12	0.91	2.99	4.43	4.43
612213	0.78	3.52	2.63	2.74	2.15	1.61	1.44	1.53	1.36	1.36	1.71	1.54	1.22	1.91	3.23	2.91	4.11	4.12
612221	0.93	4.15	3.05	3.16	2.32	1.75	1.67	2.83	1.67	1.58	2.12	1.67	1.00	1.49	2.62	1.94	2.72	2.83
612222	1.11	4.83	3.62	3.88	2.91	2.08	1.99	3.38	1.99	2.08	2.59	2.18	1.36	1.89	3.50	2.69	3.75	3.75
612223	0.91	5.01	3.78	4.04	3.09	2.10	1.83	3.44	1.93	1.84	2.50	2.03	1.20	1.87	3.61	3.74	3.88	4.01
612231	0.74	4.14	2.88	3.42	2.39	1.67	1.35	2.88	1.43	1.43	1.93	1.43	0.68	1.20	2.21	1.69	2.40	2.50
612232	0.73	5.04	3.50	4.14	3.13	2.40	2.23	3.55	2.09	2.09	2.82	2.47	1.80	2.51	4.31	3.71	5.80	5.81
612233	0.82	4.14	2.74	3.17	2.53	1.96	1.78	2.84	1.78	1.69	2.23	1.86	1.43	2.22	3.73	3.13	4.36	4.50
612241	0.92	4.51	3.19	3.74	2.82	2.13	1.51	3.34	2.03	2.04	2.49	2.16	1.35	1.86	3.27	2.55	3.58	3.72
612243	0.73	4.40	2.87	3.30	2.64	2.04	1.71	2.93	1.74	1.75	2.34	2.11	1.37	2.04	3.79	3.11	4.69	4.88
612251	0.58	2.78	1.85	2.35	1.76	1.31	1.14	2.05	1.14	1.14	1.57	1.22	0.73	0.97	1.76	1.22	1.76	1.85
612252	0.98	5.01	3.54	4.32	3.15	2.52	2.07	3.90	2.10	2.11	2.83	2.36	1.52	1.65	3.75	2.85	3.98	4.14
612253	1.36	6.25	4.31	5.21	4.50	3.02	2.64	4.88	2.67	2.68	3.49	3.09	2.03	2.88	5.20	3.91	5.67	5.88
612261	0.67	3.22	2.21	2.64	2.01	1.53	1.44	2.53	1.35	1.35	1.81	1.44	0.83	1.17	1.91	1.53	2.11	2.21
612262	0.90	4.19	3.09	3.48	2.62	2.07	1.87	3.25	1.99	1.89	2.44	2.01	1.25	1.74	2.84	2.29	3.13	3.26
612312	1.19	5.53	4.03	4.43	3.27	2.57	2.24	4.02	2.40	2.24	2.90	2.39	1.46	1.91	3.06	2.38	3.23	3.41
612313	1.07	5.00	3.89	4.19	2.97	2.38	2.06	3.77	2.18	2.08	2.64	2.20	1.22	0.80	2.80	2.04	2.83	3.08
612321	0.97	4.41	3.41	3.82	2.68	2.13	1.83	3.43	2.04	2.05	2.48	2.06	1.29	1.68	2.53	2.11	2.79	2.91
612322	0.78	3.83	2.71	3.06	2.29	1.79	1.51	2.74	1.62	1.62	2.02	1.64	1.03	1.39	2.28	1.71	2.43	2.54
612323	0.96	4.50	3.37	3.77	2.77	2.12	1.83	3.28	2.04	1.95	2.59	2.17	1.32	1.80	2.88	2.25	3.05	3.30
612331	1.05	5.04	3.79	4.23	2.95	2.44	2.15	3.83	2.27	2.18	2.79	2.20	1.23	1.71	2.55	2.02	2.81	3.03
612332	0.93	4.33	3.25	3.63	2.35	2.05	1.85	3.40	1.97	1.87	2.38	1.89	1.17	1.62	1.46	1.85	2.47	2.69
612333	0.98	4.69	3.53	4.08	2.95	2.24	1.97	3.57	2.18	2.09	2.68	2.20	1.30	1.79	2.96	2.19	2.91	3.14

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 20

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
612341	0.95	4.70	3.49	4.06	3.02	2.28	1.99	3.81	2.11	2.03	2.74	2.24	1.31	1.74	2.62	2.16	3.01	3.13
612342	1.45	6.61	5.36	5.83	4.24	3.35	2.97	5.20	3.12	3.00	3.98	3.15	1.95	2.59	4.07	3.25	4.46	4.64
612343	1.06	4.98	3.87	4.17	3.12	2.38	2.10	3.78	2.31	2.22	2.84	2.33	1.40	1.91	3.13	2.32	3.19	3.43
612351	0.89	4.33	3.19	3.46	2.59	1.93	1.63	3.08	1.74	1.74	2.26	1.84	1.00	1.36	2.17	1.66	2.29	2.41
612352	1.07	4.73	3.79	4.08	3.03	2.38	2.09	3.67	2.29	2.20	2.71	2.20	1.34	1.76	2.96	2.24	2.98	3.10
612361	0.90	4.66	3.61	3.90	2.85	2.17	1.86	3.37	1.98	1.99	2.54	2.00	1.06	1.43	2.47	1.86	2.52	2.63
612362	0.80	3.97	3.03	3.28	2.37	1.88	1.70	3.05	1.71	1.72	2.19	1.82	1.08	1.48	2.64	1.95	2.45	2.56
612371	0.81	4.18	3.21	3.47	2.61	1.96	1.66	3.10	1.77	1.77	2.19	1.78	0.96	1.32	2.13	1.64	2.38	2.49
612372	0.83	4.06	3.15	3.39	2.50	1.94	1.68	3.05	1.78	1.78	2.33	1.88	1.10	1.48	2.47	1.84	2.50	2.61

TABLE AII-II. ABSORPTIVITIES FOR WEATHERED OILS. FILE 22

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
623000	2.04	4.43	3.52	4.58	3.65	2.88	2.32	4.17	2.24	2.24	2.70	2.34	1.46	1.85	2.27	1.79	2.39	2.48
623101	1.69	4.33	3.42	4.34	3.32	2.78	2.04	4.07	2.14	2.14	2.70	2.33	1.52	1.84	2.45	1.86	2.58	2.68
623102	1.38	3.89	3.04	3.90	2.94	2.43	1.81	3.53	1.82	1.83	2.27	2.01	1.30	1.62	2.23	1.74	2.46	2.46
623301	1.77	4.16	3.37	4.31	3.26	2.92	2.13	3.90	2.23	2.14	2.73	2.24	1.64	2.07	2.86	2.27	2.88	2.99
623302	1.77	4.33	3.42	4.33	3.31	2.77	2.12	4.06	2.13	2.13	2.69	2.40	1.57	1.89	2.42	1.91	2.63	2.73
623303	2.38	5.60	4.51	5.81	4.51	3.78	2.81	5.22	2.93	2.93	3.66	3.17	2.04	2.53	3.56	2.65	3.58	3.71
623381	2.68	5.94	4.83	6.15	4.67	4.02	2.99	5.58	2.86	3.00	3.59	3.16	2.09	2.49	3.34	2.40	3.38	3.53
623382	2.75	6.35	4.99	6.36	5.00	4.14	3.22	5.97	3.08	3.23	3.85	3.39	2.02	2.56	3.59	2.60	3.63	3.63
623451	2.39	5.11	4.11	5.30	4.13	3.38	2.55	4.80	2.57	2.71	3.12	2.72	1.72	2.10	2.77	2.02	2.82	2.82
623452	1.64	3.52	2.75	3.51	2.60	2.31	1.90	3.35	1.76	1.76	2.30	1.89	1.25	1.62	2.15	1.48	2.01	2.14
623453	2.62	6.37	4.94	6.38	4.77	4.06	3.41	5.76	3.11	3.12	3.92	3.44	2.27	2.85	3.81	2.89	3.85	4.02
623454	1.97	4.89	3.81	4.70	3.64	3.16	2.40	4.34	2.41	2.41	3.01	2.70	1.85	2.27	3.18	2.42	3.19	3.35
624000	1.91	4.39	3.60	4.54	3.61	2.94	2.37	4.13	2.20	2.20	2.77	2.30	1.50	1.82	2.34	1.77	2.46	2.56
624101	1.80	4.28	3.49	4.43	3.38	2.83	2.53	4.16	2.18	2.27	2.75	2.37	1.46	1.78	2.40	1.81	2.62	2.62
624102	1.97	5.08	3.83	4.90	3.84	3.10	2.46	4.43	2.37	2.47	3.00	2.58	1.93	1.94	2.71	1.97	2.84	2.95
624342	1.75	4.12	3.53	4.26	3.36	2.81	2.05	3.91	2.02	2.26	2.63	2.23	1.62	1.83	2.54	2.13	2.73	2.72
624343	2.65	6.30	5.36	6.29	5.00	4.19	3.44	5.89	3.02	3.29	4.01	3.28	2.22	2.72	3.98	2.96	3.95	4.10
624451	1.73	4.41	3.53	4.60	3.38	2.30	2.30	4.24	2.17	2.17	2.76	2.18	1.50	1.91	2.64	1.93	2.66	2.66
624452	1.52	4.02	3.21	3.86	3.06	2.47	2.06	3.54	1.93	1.93	2.48	2.20	1.54	1.94	2.49	1.95	2.65	2.65
624453	1.30	3.63	3.15	3.30	2.99	2.39	1.69	3.15	1.69	1.69	2.10	1.97	1.43	1.83	2.39	1.97	2.54	2.54

Description of Oils Listed in File 10

Unweathered, Evacuated Oils

135000	177000	607000
137000	178000	612000
140000	188000	616000
149000	191000	617000
152000	192000	618000
161000	213000	622000
171000	417000	623000
172000	603000	624000
174000	605000	626000

NaCl/H_2O Treated-Evacuated Unweathered Oils

172900	192900	616900	622900
188900	213900	617900	623900
191900	417900	618900	626900

Evacuated-Weathered Oils

172301,302,303	213102,103,301,302,303	618301,302,303
188301,302,303	417301,302,303	622301,302,303
191301,302,303	616401,402,403	623401,402,403
192401	617401,402,403	626301,302,303 102,103

Weathered Oils

188371,372,373	417371,372,373	618371,372,373
191371,372,373	616451,452,453	623451,452,453
192451	617451,452,453	

TABLE AII-III. ABSORPTIVITIES FOR VACUUM-TREATED OILS. FILE 10

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
135000	1.26	7.52	5.28	5.48	3.99	3.02	2.57	4.51	2.56	2.85	3.63	2.99	1.85	2.25	2.81	2.50	3.40	3.56
137000	1.01	7.69	5.08	3.49	2.65	2.01	1.65	2.50	1.63	1.63	2.23	2.09	1.26	1.47	2.04	1.90	2.25	2.24
140000	1.05	7.01	4.59	3.23	2.03	1.74	1.38	2.13	1.38	1.38	1.92	1.83	1.03	1.19	1.45	1.44	1.80	1.89
149000	1.65	9.23	6.81	6.36	4.55	3.53	3.22	5.31	2.92	3.22	4.04	3.38	1.80	2.35	2.93	2.64	3.72	3.89
152000	2.03	10.51	7.92	7.12	4.89	3.78	3.45	5.73	3.13	3.29	4.34	3.64	2.24	2.85	4.02	3.19	4.23	4.61
161000	1.09	3.87	3.30	4.33	2.79	2.09	1.99	3.31	1.88	1.88	2.32	1.89	1.01	1.29	2.00	1.49	2.12	2.23
171000	1.04	4.72	3.66	4.40	3.27	2.54	2.66	4.25	2.32	2.32	3.14	2.32	1.33	1.81	2.91	2.02	2.79	3.04
172000	1.15	4.37	3.56	4.17	3.10	2.60	2.33	4.05	2.38	2.47	2.97	2.29	1.39	1.78	2.97	2.02	2.87	2.97
172301	1.58	6.44	5.61	6.44	4.85	3.99	3.67	6.01	3.66	3.51	4.49	3.50	2.21	2.90	5.01	3.49	4.64	5.00
172302	1.28	5.72	4.63	5.33	4.45	3.50	3.06	5.14	3.06	3.05	3.95	3.19	1.97	2.62	4.58	3.31	4.39	4.73
172303	1.90	8.20	6.48	7.68	5.85	4.69	4.34	7.45	4.36	4.36	5.68	4.55	2.80	3.57	6.57	4.61	6.39	6.62
172900	1.33	6.35	4.80	5.74	4.13	3.35	3.06	5.56	3.07	3.22	3.99	3.23	1.87	2.40	4.36	2.98	4.06	4.22
174000	1.02	4.19	3.61	4.69	3.50	2.78	2.78	4.55	2.80	2.91	3.41	2.60	1.58	2.22	3.10	2.47	4.06	4.21
177000	1.02	4.84	3.84	4.53	3.36	2.72	2.83	4.39	2.45	2.64	3.26	2.64	1.40	1.78	2.48	2.05	2.99	3.09
178000	1.19	4.58	4.00	4.74	3.62	3.04	2.44	4.60	2.36	2.45	2.96	2.19	1.32	1.78	2.59	1.89	2.72	2.82
188000	1.17	5.73	4.64	4.64	3.52	2.80	2.40	4.14	2.27	2.40	2.94	2.27	1.41	1.77	3.08	2.27	2.94	2.94
188301	1.70	7.49	6.42	6.62	4.93	3.82	3.38	5.83	3.38	3.38	4.28	3.38	2.06	2.56	4.44	3.24	4.28	4.44
188302	1.67	7.33	5.83	6.03	4.55	3.58	3.14	5.26	3.00	3.14	3.90	3.15	2.19	2.59	4.40	3.31	4.24	4.41
188303	1.56	7.83	6.04	6.05	4.75	3.77	3.17	5.30	3.18	3.19	3.95	3.35	2.12	2.66	4.82	3.55	4.69	4.87
188371	1.20	5.39	4.41	4.79	3.88	3.71	2.90	4.43	2.46	2.31	3.07	2.32	1.63	1.77	2.94	2.21	2.96	2.97
188372	1.22	5.95	4.81	4.82	3.67	2.93	2.38	4.17	2.40	2.41	2.97	2.42	1.55	1.93	3.32	2.36	3.22	3.22
188373	1.95	9.72	8.15	7.88	5.91	4.68	3.77	6.89	3.99	3.82	4.96	4.04	2.60	3.26	5.93	4.39	5.83	6.05
188900	1.16	5.63	4.57	4.57	3.47	2.77	2.37	3.73	2.37	2.37	2.90	2.37	1.39	1.74	3.04	2.24	2.90	2.90
191000	1.39	5.63	4.73	4.73	3.46	2.76	1.98	3.61	1.97	1.97	2.75	2.22	1.48	1.72	2.47	1.96	2.59	2.73
191301	0.76	3.68	3.07	3.08	2.10	1.59	1.35	2.24	1.23	1.12	1.60	1.36	0.89	1.01	1.74	1.37	1.87	2.00
191302	1.16	5.09	3.93	4.24	3.04	2.24	1.86	3.04	1.86	1.86	2.37	2.11	1.51	1.74	2.63	2.24	2.77	2.90
191303	2.19	10.03	7.70	7.71	5.69	4.05	3.57	5.93	3.76	3.45	4.63	4.30	3.20	4.01	5.87	5.14	6.59	6.60
191371	1.28	5.60	4.26	4.62	2.79	2.79	2.07	3.58	1.94	1.94	2.64	2.21	1.41	1.67	2.21	2.07	2.50	2.64
191372	2.18	8.08	6.67	6.46	4.23	3.30	2.87	4.75	3.03	3.03	3.78	3.48	2.36	2.77	3.97	3.37	4.16	4.32
191373	1.62	8.07	5.65	5.88	4.32	3.15	2.54	4.35	2.88	2.44	3.54	3.24	2.36	2.98	4.53	3.87	5.00	5.40
191900	2.23	9.54	8.12	8.12	5.62	4.17	3.37	6.02	3.37	3.37	4.51	3.84	2.36	2.78	4.00	3.07	4.17	4.51
192000	0.93	4.56	3.46	3.03	2.22	1.72	1.37	2.34	1.48	1.59	1.95	1.71	1.35	1.58	1.93	1.68	2.16	2.16
192401	1.78	7.56	6.01	5.24	3.56	2.97	2.29	4.03	2.42	2.55	3.11	2.96	2.15	2.68	3.54	2.95	3.84	4.00
192451	0.87	3.87	2.94	2.65	1.95	1.44	1.31	2.07	1.30	1.29	1.66	1.53	1.15	1.51	1.74	1.47	1.96	2.09
192900	1.36	6.02	4.93	4.28	2.96	2.43	1.94	3.38	2.06	2.06	2.56	2.31	1.82	2.06	2.43	2.18	2.83	2.96

TABLE AII-III. ABSORPTIVITIES FOR VACUUM-TREATED OILS. FILE 10

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
213000	1.06	6.85	4.52	3.39	2.81	2.00	1.62	2.38	1.37	1.60	2.10	1.96	1.11	1.33	1.80	1.66	2.01	2.14
213102	0.96	5.76	3.73	2.87	1.92	1.64	1.46	2.11	1.27	1.44	1.81	1.71	1.00	1.24	1.68	1.48	1.75	1.84
213103	1.09	8.09	5.40	3.81	2.46	1.92	1.66	2.59	1.65	1.77	2.29	2.15	1.25	1.49	2.11	1.96	2.07	2.33
213301	1.51	9.51	5.35	4.21	2.79	2.40	2.15	3.03	1.89	2.00	2.61	2.47	1.62	1.95	2.66	2.25	2.73	2.85
213302	1.41	9.13	5.80	4.51	3.09	2.53	2.12	3.22	1.98	2.11	2.77	2.77	1.71	2.07	2.73	2.43	2.83	3.11
213303	1.32	8.78	5.89	4.33	3.01	2.22	1.97	2.99	1.95	2.07	2.69	2.55	1.56	1.90	2.76	2.34	2.70	2.97
213900	1.27	9.16	5.73	4.41	3.13	2.37	2.01	3.12	2.00	2.11	2.84	2.58	1.53	1.74	2.42	2.29	2.51	2.63
417000	3.18	9.06	7.68	13.21	9.08	7.96	6.51	13.24	8.52	6.10	9.74	6.33	2.97	4.08	7.06	4.47	6.01	6.44
417301	1.57	4.45	3.95	6.78	4.63	3.96	2.90	6.79	4.30	3.06	4.82	3.21	1.60	2.11	3.84	2.67	3.10	3.40
417302	1.40	4.56	3.54	6.15	4.22	3.55	2.94	5.74	3.73	3.10	4.42	3.27	1.84	2.40	4.28	3.31	3.97	4.32
417303	1.78	6.43	5.33	8.86	5.57	4.78	4.05	8.04	5.42	4.27	6.32	4.87	2.84	3.84	6.92	5.22	6.79	7.04
417371	1.61	4.12	3.42	6.62	4.88	3.95	2.79	7.65	4.32	2.96	4.33	2.81	1.25	1.93	3.15	2.10	2.70	2.85
417372	1.41	4.70	3.85	6.75	4.04	3.72	2.82	6.35	4.09	3.15	4.81	3.33	1.82	2.37	4.22	3.02	3.98	4.16
417373	1.06	3.78	3.14	5.05	3.81	2.72	2.30	4.53	3.05	2.47	3.70	2.78	1.57	2.25	3.79	2.89	3.66	4.03
417900	2.09	6.72	6.04	9.78	6.05	5.42	4.47	9.16	5.64	4.67	6.75	4.68	2.28	3.17	5.28	3.68	4.93	5.12
603000	1.26	6.80	5.49	5.10	3.67	2.89	2.45	4.18	2.59	2.74	3.50	2.73	1.37	2.16	3.33	2.43	3.17	3.32
605000	1.56	7.46	6.27	8.84	8.00	4.85	4.30	8.57	5.25	4.50	7.25	5.08	1.76	2.18	4.56	2.78	3.58	3.75
607000	1.45	4.85	5.03	7.84	5.40	4.31	3.82	7.83	4.83	4.13	5.01	3.48	1.67	2.31	3.78	2.57	3.76	3.76
612000	1.09	4.91	4.01	4.18	3.10	2.43	2.43	3.85	2.18	2.31	2.82	2.18	1.29	1.72	2.43	1.83	2.82	2.82
616000	1.37	4.96	4.42	6.36	4.61	3.93	3.61	6.60	3.94	3.46	4.81	3.17	1.54	1.93	3.35	2.22	3.08	3.09
616401	1.83	7.74	6.99	9.49	6.54	5.48	4.71	9.54	5.93	5.13	7.58	5.16	2.25	2.99	5.64	3.85	4.76	5.14
616402	1.31	6.06	5.63	7.23	5.05	3.81	3.48	7.02	4.53	3.51	5.71	3.86	1.80	2.51	4.80	3.31	4.33	4.51
616403	1.54	7.86	7.07	8.77	6.61	4.69	4.32	8.54	5.55	4.95	7.22	5.20	2.47	3.28	6.63	4.61	6.30	6.54
616451	1.52	6.53	5.84	8.42	5.65	5.03	4.45	9.09	5.47	4.48	6.62	4.32	1.79	2.53	4.78	3.06	4.29	4.30
616452	1.25	5.40	4.99	6.55	3.88	3.72	3.22	6.35	4.29	3.42	5.08	3.61	1.65	2.24	4.40	2.91	3.76	3.95
616453	1.09	5.74	5.07	6.50	3.71	3.19	2.86	6.08	3.98	2.92	5.01	3.49	1.47	2.09	4.56	3.00	4.12	4.33
616900	1.78	7.19	6.50	9.08	5.88	5.09	4.55	9.12	5.51	4.76	6.81	4.61	1.90	2.46	4.86	3.10	4.23	4.41
617000	1.41	5.53	5.14	7.33	5.75	4.97	4.79	8.41	4.62	4.10	5.79	3.62	1.50	2.04	3.67	2.35	4.22	4.23
617401	1.44	6.47	5.86	8.10	5.49	4.77	4.43	8.39	4.97	4.63	6.54	4.48	1.79	2.44	4.54	2.90	4.11	4.28
617402	1.83	7.73	7.22	8.86	6.30	5.26	5.07	9.51	5.90	5.09	7.54	5.31	2.07	2.80	5.38	3.46	4.68	4.87
617403	1.18	5.76	5.16	6.41	4.81	3.62	3.31	6.47	4.15	3.83	5.46	3.70	1.71	2.27	4.64	3.21	4.38	4.56
617451	1.30	5.62	5.40	7.63	5.22	4.82	4.63	8.89	4.86	4.10	5.74	3.60	1.34	2.07	3.70	2.30	3.29	3.47
617452	1.84	8.33	8.04	9.99	6.74	5.82	5.61	10.82	6.57	5.67	8.19	5.29	2.07	2.86	5.63	3.62	5.15	5.16
617453	0.72	3.73	3.39	4.08	2.48	2.35	2.07	4.12	2.67	2.38	3.47	2.26	0.95	1.35	2.76	1.93	2.53	2.68
617900	1.26	5.55	5.16	6.60	4.63	3.96	3.64	6.86	4.15	3.67	5.42	3.69	1.36	1.88	3.44	2.32	3.35	3.36

TABLE AII-III. ABSORPTIVITIES FOR VACUUM-TREATED OILS. FILE 10

FREQ.- ID.NO.	695	720	725	740	765	780	790	810	835	845	870	890	915	955	1020	1070	1145	1160
618000	1.45	4.97	4.28	8.78	5.74	5.17	3.96	9.07	5.75	3.81	6.16	3.51	1.25	1.86	3.68	2.13	2.54	2.68
618301	1.73	5.07	4.39	8.24	4.88	4.54	3.59	7.97	5.41	3.73	5.78	3.57	1.68	2.04	4.00	2.40	2.93	3.07
618302	1.54	6.16	5.53	8.66	5.35	4.24	3.58	7.87	5.58	4.27	6.22	4.12	1.76	2.31	4.88	3.07	3.89	4.06
618303	1.43	6.06	5.23	8.56	5.25	4.32	3.48	7.77	5.28	4.01	6.13	3.86	1.80	2.23	4.99	3.31	4.15	4.33
618371	1.37	4.37	3.83	8.09	4.97	4.77	3.32	8.70	5.39	3.50	5.61	3.17	1.14	1.82	3.36	1.84	2.43	2.59
618372	1.66	6.07	5.26	10.04	5.10	4.92	3.88	9.13	6.35	4.25	7.29	4.28	1.67	2.21	4.71	2.84	3.48	3.80
618373	1.69	6.83	5.70	9.65	5.08	4.70	3.80	8.70	6.13	4.33	7.32	4.15	1.97	2.54	5.28	3.30	4.15	4.51
618900	0.84	3.83	3.37	5.54	3.23	2.53	2.27	4.81	3.23	2.53	3.83	2.40	0.95	1.29	2.67	1.52	2.01	2.14
622000	1.25	6.10	5.09	5.48	4.29	3.35	3.24	5.12	2.92	3.14	3.76	2.83	1.56	2.08	2.99	2.49	3.61	3.62
622301	1.20	6.33	5.52	5.72	4.61	3.47	3.32	5.33	3.03	3.03	3.94	3.03	1.81	2.33	3.62	2.88	3.94	3.94
622302	1.32	6.54	5.91	5.91	4.95	3.77	3.46	5.71	3.46	3.46	4.09	3.30	1.92	2.58	4.41	3.44	4.57	4.57
622303	1.05	6.31	5.15	5.16	4.35	3.25	2.92	4.78	2.95	2.95	3.48	2.98	1.75	2.54	5.13	3.61	5.21	5.43
622900	0.98	4.79	4.11	4.11	3.48	2.75	2.48	3.95	2.21	2.35	2.90	2.22	1.22	1.59	2.49	1.97	2.64	2.78
623000	2.50	5.83	4.92	6.03	4.75	3.94	2.91	5.46	2.78	2.92	3.64	3.06	2.01	2.39	3.21	2.40	3.36	3.37
623401	2.60	6.73	5.92	6.73	5.36	4.50	3.28	6.32	3.42	3.57	4.34	3.57	2.47	3.00	3.87	3.00	4.02	4.18
623402	3.03	7.47	6.14	7.48	5.94	4.98	3.65	6.79	3.35	3.81	4.64	4.14	2.78	3.37	4.67	3.54	4.69	4.69
623403	2.37	5.45	4.74	5.63	4.40	3.62	2.63	5.09	2.77	2.90	3.47	3.18	2.11	2.77	3.62	2.90	3.77	3.77
623451	1.64	3.52	3.05	3.51	2.60	2.31	1.77	3.35	1.76	1.76	2.30	1.89	1.25	1.62	2.15	1.61	2.01	2.14
623452	2.62	6.37	4.94	6.38	4.95	4.06	2.95	5.76	2.96	3.12	3.92	3.44	2.27	2.85	3.81	2.89	3.85	4.02
623453	1.97	4.89	4.15	4.70	3.64	3.16	2.40	4.34	2.41	2.41	3.01	2.70	1.85	2.27	3.18	2.42	3.19	3.35
623900	1.58	4.17	3.52	4.17	3.37	2.78	1.96	3.68	2.09	2.09	2.64	2.23	1.34	1.71	2.23	1.71	2.23	2.36
624000	1.71	4.76	4.01	4.76	3.47	2.97	2.31	4.29	2.30	2.41	2.85	2.41	1.51	1.89	2.51	1.88	2.61	2.72
626000	1.34	5.42	4.17	4.68	3.52	2.64	2.36	4.00	2.36	2.36	3.07	2.50	1.46	1.96	3.07	2.36	3.37	3.52
626102	1.11	4.79	3.59	4.01	3.08	2.49	2.07	3.59	2.07	2.17	2.72	2.17	1.29	1.76	2.61	2.07	2.96	3.08
626103	1.70	7.59	5.80	6.43	4.84	3.82	3.19	5.79	3.34	3.49	4.30	3.48	2.05	2.87	4.28	3.30	4.60	4.78
626301	1.41	5.42	4.19	4.87	3.70	2.95	2.53	4.33	2.52	2.66	3.22	2.51	1.73	2.23	3.19	2.47	3.46	3.61
626302	1.29	5.42	4.19	4.52	3.70	2.95	2.40	4.17	2.52	2.52	3.08	2.65	1.73	2.36	3.49	2.74	3.77	3.92
626303	1.07	4.36	3.56	3.71	2.97	2.28	1.89	3.40	1.88	2.01	2.53	2.13	1.38	1.87	2.93	2.23	3.05	3.19
626900	1.06	4.47	3.52	3.98	3.08	2.40	1.89	3.37	1.89	2.01	2.53	1.89	1.17	1.64	2.40	1.89	2.67	2.67

APPENDIX III. PROGRAM LISTINGS AND DESCRIPTIONS

These programs were written for use on the I.B.M 370/155 Computer at the University of Rhode Island's Computer Science Center. The programs were all written in Fortran and should be easily adaptable to other computer systems.

PROGRAM: IDENT

PURPOSE: To store and catalog informational data on unweathered and weathered oils in computer data files for subsequent display by program INFO.

METHOD: For unweathered oils, the oil's six digit ID No., type of oil, company from where it was received, date received and origin are entered into data file IKW. For weathered oils, the oil's six digit ID No., amount of weathering in hours, sampling dates, air and water temperatures, wind velocities, cloud cover and laboratory conditions are entered into data files UNKA thru UNKJ. The oils are arranged by increasing ID No.. There are options for entering unweathered data only, weathered data only, both unweathered and weathered data, and for selectively removing any of the data.

PROGRAM: INFO

PURPOSE: To display informational data on unweathered and weathered oils.

METHOD: INFO displays the oil ID No., type of oil, company from where it was received, date received, and origin for unweathered oils. For weathered oils it first displays the unweathered oil data followed by the corresponding weathered oil's six digit ID No., amount of weathering in hours, sampling dates, air and water temperatures, wind velocity, cloud cover, and laboratory conditions. File IKW contains unweathered data and files UNKA thru UNKJ contain the weathered oil data. (These files are modified and maintained by program IDENT). Options are display of one selected weathered oil, all weathering data on one selected oil, all data on one type of oil, all unweathered data, and for all data. The displays are formatted for a width of 80 columns to facilitate display on teletypes and CRT's.

PROGRAM: TOIL

PURPOSE: To store % transmission data of an oil along with the oil's six digit ID No. , pathlength, type of cell, and window thickness if measured on NaCl in computer data files for subsequent processing by programs SEARCH and COCO.

METHOD: The % transmissions at 18 selected frequencies are manually coded along with the % transmissions at 1950 and 650 cm^{-1}. These data along with the oil's

six digit ID No., the cell pathlength in millimeters, the type of sample cell (01 for NaCl, 02 for AgCl and 03 for KBr), and the window thicknesses in millimeters, if measured on NaCl, are then entered into any of 23 permanent computer files. The oils are arranged by increasing oil ID No. Unweathered oils are stored in files 1-8 and weathered oils in files 11-18. The other files are reserved for special cases such as actual spills, pretreatment studies, Coast Guard test cases, etc. There are options for selectively removing data, correcting and modifying data, displaying oil ID No., and displaying oil ID No. along with the transmission and cell data.

PROGRAM: SEARCH
PURPOSE: To compare 18 absorptivities from the infrared spectra of an oil to those of other oils by the "ratio method."
METHOD: The absorptivities are calculated from % transmissions of 18 selected bands and that of the background. The % transmissions for the "questionable" oil can be entered through the terminal or retrieved from any one of 23 data files. The % transmissions for the comparison oils are taken from any one of the selected files. The comparison can be made with all of the oils in the file, or only with those oils having the same first three digits in the identification numbers. This latter option makes it possible to compare an unweathered oil with only its weathered samples, or one weathered sample with all other weathered samples of the same oils.
For AgCl and KBr cells, a linear baseline between 1950 and 650 cm^{-1} is calculated; the reason for using a linear rather than a horizontal baseline is given in Sec. IV-D-1-b. For NaCl cells, the baseline between 810 and 650 cm^{-1} is assumed to follow a cubic equation, and is corrected by using the % transmission value at 650 cm^{-1} and the window thickness. A horizontal baseline is obtained.
The number of ratios within limits and the probability of a correct match are listed; however, there is an option to by-pass this listing. Finally, the log-ratios can be listed for any or all oils.

PROGRAM: COCO
PURPOSE: To calculate the correlation coefficients between a "questionable" oil and all oils stored in one of the 23 computer data files.
METHOD: The absorptivities are calculated from % transmissions of 18 seleted bands and that of the background. The % transmissions for the "questionable" oil can be entered through the

terminal or retrieved from any one of 23 data files. The % transmissions for the comparison oils are taken from any one of the selected files. The comparisons can be made will all of the oils in the file, or only with those oils having the same first three digits in the identification numbers. After calculating the correlation coefficients, the oils in the comparison file are ordered by decreasing correlation coefficients, and the identification numbers and correlation coefficients are listed.

IDENT

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•                 IDENT ENTERS THE UNWEATHERED OIL INFORMATION INTO FILE IKN.
•                 THE INFORMATION CONSISTS OF OIL ID#, TYPE OF OIL, COMPANY
•                 FROM WHERE IT CAME, DATE RECEIVED, AND COUNTRY OF ORIGIN.
•                 IDENT ENTERS THE WEATHERED OIL INFORMATION INTO FILES
•                 UNKA THRU UNKJ. THE INFORMATION CONISTS OF OIL ID#, AMOUNT
•                 OF WEATHERING IN HOURS, SAMPLING DATE, AIR TEMP., WATER TEMP.,
•                 WIND VELOCITY, CLOUD COVER, AND LAB CONDITIONS.
•                 THE UNWEATHERED AND WEATHERED DATA ARE DISPLAYED BY
•                 PROGRAM INFO.
      DIMENSION A(300,2),B(300,6),JA(300),JB(300),JC(25),JD(25),JE(25),%
      JA1(1000),JB1(1000),JC1(1000),JD1(1000),JE1(1000),JA2(1000)%
      ,KNUM(300),KNUMB(300),KNUMD(20),KNUMD1(20),K(300),JF(25),JG(25),%
      JF1(1000),JG1(1000)
      I9 = 0
•                IY = -1 KNOWNS ONLY, 0 BOTH, + 1 UNKNOWNS ONLY
      II = 0
      WRITE (6,903)
      READ (5,902) IY
      IF (IY) 11,11,29
   11 CALL OPEN (2,'IKN','INPUT')
•                READ IN THE UNWEATHERED OIL DATA FROM FILE IKN
•                I1 = NUMBER OF KNOWNS STORED
      READ (2,902) I1
      IF (I1) 2,2,1
    1 DO 5 I = 1,I1
•                KNUM(I) = UNWEATHERED OIL ID NUMBER
•                A(I,M) = TYPE OF OIL
•                JA(I) = COMPANY
•                JB(I) = DATE RECEIVED
•                B(I,M) = ORIGIN (COUNTRY, ETC.)
    5 READ (2,905) KNUM(I),(A(I,M),M=1,2),JA(I),(B(I,M),M=1,6),JB(I)
      WRITE (6,916)
      READ (5,917) IAA
•                IAA = NUMBER OF UNWEATHERED OILS TO BE REMOVED FROM FILE IKN
      IF (IAA) 2,2,28
   28 WRITE (6,918)
      READ (5,919) (KNUMD(I),I=1,IAA)
•                KNUMD(I) = OIL ID NUMBERS TO BE REMOVED FROM FILE IKN
•                SET THE OIL ID NUMBERS TO BE REMOVED EQUAL TO ZERO
      DO 10 I = 1,IAA
      DO 12 J = 1,I1
```

IDENT

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      IF (KNUM(J) - KNUMD(I)) 12,13,12
   13 KNUM(J) = 0
      GO TO 10
   12 CONTINUE
   10 CONTINUE
    2 CALL CLOSE (2)
 *                  NEW OIL INFORMATION IS READ IN
      I = I1
   14 WRITE (6,904)
   15 I = I + 1
      READ (5,915) KNUM(I),(A(I,M),M=1,2),JA(I),JB(I),(B(I,M),M=1,6)
      II = II + 1
      IF (KNUM(I)) 24,24,16
   16 IF (II - 5) 15,17,17
   17 II = 0
      GO TO 14
   24 I1 = I - 1
      II = 0
      DO 18 I = 1,I1
   18 KNUMB(I) = KNUM(I)
 *                  UNWEATHERED OILS ARE ORDERED BY INCREASING ID NUMBERS  TO STATEMENT 23
      DO 23 M = 1,I1
      DO 22 I = 1,I1
      IO = I
      IF (KNUMB(IO)) 22,22,19
   19 DO 21 J = 1,I1
      JJ = J + IO
      IF (KNUMB(JJ)) 3,3,20
    3 IF (JJ - I1) 21,6,6
   20 IF (KNUMB(IO) - KNUMB(JJ))4,22,7
    4 IF (JJ - I1)21,6,6
    6 II = 1 + II
      K(II) = IO
      KNUMB(IO) = 0
      GO TO 23
    7 IF (JJ-I1) 8,9,9
    8 IO = JJ
      GO TO 19
    9 II = II + 1
      K(II) = JJ
```

IDENT

```
     KNUMB(JJ) = 0
     GO TO 23
  21 CONTINUE
  22 CONTINUE
  23 CONTINUE
*                   UNWEATHERED OIL DATA STORED IN FILE IKN
 25 CALL OPEN (2,'IKN','OUTPUT')
     I1 = I1 - IAA
     WRITE (2,902) I1
      DO 26 J = 1,I1
      I = K(J)
 26 WRITE (2,905) KNUM(I),(A(I,M),M=1,2),JA(I),(B(I,M),M=1,6),JB(I)
      CALL CLOSE (2)
      DO 27 I = 1,300
      JA(I) = 0
 27 JB(I) = 0
      DO 34 I = 1,20
 34 KNUMD(I) = 0
      I1 = 0
 *                   END UNWEATHERED OIL DATA INPUT
 *
 *                   START WEATHERED OIL DATA  INPUT (IF IY IS 0 OR +1)
 29 IF (IY) 110,32,32
 32 I = 0
      JZ2 = 0
      I6 = 0
      JACK = 0
      II = 0
      I8 = 1
      WRITE (6,921)
      READ (5,917) I1
 *                   I1 = NUMBER OF WEATHERED OILS TO BE REMOVED
      IF (I1) 70,70,35
 35 WRITE (6,923)
      I5 = 0
      READ (5,924) (KNUMD(I),I=1,I1)
 *                   KNUMD(I) = WEATHERED OIL ID NUMBERS TO BE REMOVED
 *                   DETERMINE FILE NUMBER (JZ2) OF WEATHERED OILS TO BE REMOVED
 33 DO 50 I = I8,I1
 *                   I8 = COUNT OF WEATHERED OILS TO BE REMOVED THAT HAVE BEEN PROCESSED
```

IDENT

```
      Z = KNUMD(I) +100000
      Z = Z/100000.
      JZ1 = Z
      IF (JZ1 - JZ2) 36,37,36
•                  JACK = 0 FOR FIRST WEATHERED OIL TO BE REMOVED FROM A FILE
•                  JACK = 1 FOR OTHER WEATHERED OILS FROM SAME FILE
   36 IF (JACK) 51,38,51
   38 JZ2 = JZ1
      GO TO 200
•                  GO TO FILE JZ2
   37 JACK = 1
      JZ2 = JZ1
      DO 40 J = I5,I3
      IF (KNUMD(I) - JA1(J)) 40,39,40
•                  SETS WEATHERED OIL ID # TO BE REMOVED EQUAL TO ZERO SO THAT IT
•                  AND ALL ASSOCIATED NUMBERS WILL BE REMOVED DURING THE
•                  SUBSEQUENT SORTING PROCESS
   39 JA1(J) = 0
      J1 = 1 + J1
      I6 = 1 + I6
•                  J1 = NUMBER OF WEATHERED OILS REMOVED FROM THE SAME FILE
•                  I6 = TOTAL NUMBER OF WEATHERED OILS REMOVED AT THIS POINT
      GO TO 50
   40 CONTINUE
   50 CONTINUE
   51 GO TO 300
   70 I = 0
      II = 0
   78 WRITE (6,906)
   71 I = I + 1
•                  I = COUNT OF NEW WEATHERED OILS
      READ (5,925) JA(I),JB(I),JC(I),JD(I),JE(I),JF(I),JG(I)
•                  NEW WEATHERED OIL DATA READ INTO PROGRAM
•                  JA THRU JG ARE DATA FOR NEW WEATHERED OILS
      II = II+1
•                  READING OF NEW WEATHERED OILS STOPS IF THE WEATHERED OIL
•                  NUMBER JA IS ZERO
      IF (JA(I)) 75,75,73
   73 IF (25 - I) 75,75,68
   68 IF (II - 5) 71,71,74
```

IDENT

```
 74 II = 0
    GO TO 78
 *                 I2 = TOTAL NUMBER OF NEW WEATHERED OILS
 75 I2 = I - 1
    IF (I2) 110,110,72
 72 I5 = 0
 *                 I7 = COUNT OF NEW WEATHERED OILS PROCESSED
    I7 = 1
 77 DO 85 I = I7,I2
 *                 DETERMINE FILE NUMBER (JZ1 THEN JZ2) FOR NEW WEATHERED OILS
    Z = JA(I) + 100000
    Z = Z/100000.
    JZ1 = Z
    IF (JZ2) 79,80,79
 79 IF (JZ1 - JZ2) 76,80,76
 80 I5 = I5 + 1
 *                 I5 = NUMBER OF NEW WEATHERED OILS GOING INTO THE SAME FILE
 *                 PUTS THE DATA FOR NEW WEATHERED OILS (JA THRU JG) IN JA1 THRU JG1
    JA1(I5) = JA(I)
    JB1(I5) = JB(I)
    JC1(I5) = JC(I)
    JD1(I5) = JD(I)
    JE1(I5) = JE(I)
    JF1(I5) = JF(I)
    JG1(I5) = JG(I)
    JZ2 = JZ1
 85 CONTINUE
 76 I7 = I5 + I7
 *                 READS IN FILE JZ2
200 GO TO (201,202,203,204,205,206,207,208,209,210),JZ2
201 CALL OPEN (3,'UNKA','INPUT')
    GO TO 211
202 CALL OPEN (3,'UNKB','INPUT')
    GO TO 211
203 CALL OPEN (3,'UNKC','INPUT')
    GO TO 211
204 CALL OPEN (3,'UNKD','INPUT')
    GO TO 211
205 CALL OPEN (3,'UNKE','INPUT')
    GO TO 211
```

IDENT

```
206 CALL OPEN (3,'UNKF','INPUT')
    GO TO 211
207 CALL OPEN (3,'UNKG','INPUT')
    GO TO 211
208 CALL OPEN (3,'UNKH','INPUT')
    GO TO 211
209 CALL OPEN (3,'UNKI','INPUT')
    GO TO 211
210 CALL OPEN (3,'UNKJ','INPUT')
211 READ (3,902) I3
•               I3 = NUMBER OF WEATHERED OILS ALREADY IN FILE JZ2
•               I5 = NUMBER OF NEW WEATHERED OILS IF ANY
    I3 = I5 + I3
    IF (I3 - I5) 219,250,219
219 I5 = I5 + 1
    DO 220 J = I5,I3
220 READ (3,925) JA1(J),JB1(J),JC1(J),JD1(J),JE1(J),JF1(J),JG1(J)
•               JA1 = WEATHERED OIL ID# (I6)
•               JB1 = WEATHERING HOURS (I4)
•               JC1 = SAMPLING DATE (I6)
•               JD1 = AIR AND WATER TEMP. (I4)
•               JE1 = WIND VELOCITY (I2)
•               JF1 = CLOUD COVER (I1)  1 THRU 5
•               JG1 = LAB CONDITIONS (I3)
250 CALL CLOSE (3)
    IF (I1 - I6) 300,300,37
•               IF (I1 - I6) IS POSITIVE THEN MORE WEATHERED OILS
•               ARE TO BE REMOVED
300 DO 310 I=1,13
•               WEATHERED OIL ID NUMBERS JA1 PUT INTO JA2 FOR SORTING PURPOSES
310 JA2(I) = JA1(I)
    II = 0
•               SORTING OF WEATHERED OILS STATEMENT 314 TO 330
•               ALL WEATHERED OIL ID NUMBERS ARE SEARCHED FOR THE SMALLEST
•               K(1) IS SET EQUAL TO THE INDEX OF THAT NUMBER AND JA2 FOR
•               THAT NUMBER IS SET EQUAL TO ZERO.THE SEARCH IS REPEATED FOR THE
•               NEXT SMALLEST NUMBER AND K(2) IS SET EQUAL TO THE INDEX FOR
•               THAT NUMBER, ETC,ETC.
314 DO 330 I = 1,I3
    JA3 = JA2(I)
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IDENT

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      IO = I
      DO 325 J = 1,I3
      IF (JA3) 330,330,315
  315 IF (JA2(J)) 325,325,316
  316 IF (JA3 - JA2(J)) 324,324,317
  317 JA3 = JA2(J)
      IO = J
  324 IF (J - I3) 325,327,327
  325 CONTINUE
  327 II = II + 1
      K(II) = IO
      JA2(IO) = 0
      IF (I3 - II - 1) 350,326,314
  326 DO 328 III = 1,I3
      IF (JA2(III)) 328,328,329
  329 IO = III
      GO TO 327
  328 CONTINUE
  330 CONTINUE
*                   ALL SORTED WEATHERED OILS ARE STORED IN THE PROPER FILE JZ2
  350 GO TO (351,352,353,354,355,356,357,358,359,360),JZ2
  351 CALL OPEN (3,'UNKA','OUTPUT')
      GO TO 361
  352 CALL OPEN (3,'UNKB','OUTPUT')
      GO TO 361
  353 CALL OPEN (3,'UNKC','OUTPUT')
      GO TO 361
  354 CALL OPEN (3,'UNKD','OUTPUT')
      GO TO 361
  355 CALL OPEN (3,'UNKE','OUTPUT')
      GO TO 361
  356 CALL OPEN (3,'UNKF','OUTPUT')
      GO TO 361
  357 CALL OPEN (3,'UNKG','OUTPUT')
      GO TO 361
  358 CALL OPEN (3,'UNKH','OUTPUT')
      GO TO 361
  359 CALL OPEN (3,'UNKI','OUTPUT')
      GO TO 361
  360 CALL OPEN (3,'UNKJ','OUTPUT')
```

IDENT

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 •                  J1 IS THE NUMBER OF WEATHERED OILS REMOVED FROM FILE
 •                  I3 IS NOW THE NEW NUMBER WEATHERED OILS IN FILE JZ2
361 I3 = I3 - J1
    JZ2 = 0
    J1 = 0
    JACK = 0
    WRITE (3,902) I3
    IF (I3) 373,373,369
369 DO 370 I = 1,I3
    J = K(I)
370 WRITE (3,925) JA1(J),JB1(J),JC1(J),JD1(J),JE1(J),JF1(J),JG1(J)
373 CALL CLOSE (3)
 •                  I6 = TOTAL NUMBER OF WEATHERED OILS REMOVED AT THIS POINT
    I8 = I6 + 1
    I5 = 0
    IF (I1 - I6) 371,371,33
 •                  IF MORE WEATHERED OILS ARE TO BE REMOVED (I1-I6) IS POSITIVE
371 I5 = 0
    IF (I2) 70,70,372
 •                  I2 = THE NUMBER OF NEW WEATHERED OILS
 •                  I7 = THE NUMBER OF NEW WEATHERED OILS THAT HAVE BEEN
 •                  PROCESSED
372 IF (I2 - I7) 110,110,77
110 CONTINUE
902 FORMAT (I3)
903 FORMAT (' UNWEATHERED OIL DATA = -01, WEATHERED OIL DATA = +01, BOTH = 000')
904 FORMAT (// ' DATA ON UNWEATHERED OILS' / ' SAMPLE NO. I3, TYPE OF OIL A8,'%
    'COMPANY I2, DATE RECEIVED I4, ORIGIN A24')
905 FORMAT (I3,2A4,I2,6A4,I4)
906 FORMAT (///23H DATA ON WEATHERED OILS,/26H IDENTIFICATION NUMBER I6,,/%
    62H WEATHER TIME HRS I4, SAMP. DATE I6, AIR TEMP I2, H2O TEMP I2,,/%
    63H WIND KPH I2, CLOUD COVER (1 TO 5) I2, LAB CONDITIONS (1 FRESH,,/%
    64H 2 SALT, 3 WIND, 4 CONST. LIGHT 5 INTERM. LIGHT, 6 AERATION) 3I1)
907 FORMAT (I6,I4,I6,I4,I2,I1,I3)
915 FORMAT (I3,2A4,I2,I4,6A4)
916 FORMAT (62H DO YOU WANT TO REMOVE ANY UNWEATHERED OILS? LIST NUMBER TO BE%
    12H REMOVED, I2)
917 FORMAT (I2)
918 FORMAT (36H IDENTIFICATION NUMBER OF EACH, 20I3)
919 FORMAT (20I3)
```

IDENT

```
921 FORMAT (' DO YOU WANT TO REMOVE ANY WEATHERED OILS? LIST NUMBER TO BE REMOVED, I2')
923 FORMAT (36H IDENTIFICATION NUMBER OF EACH, 20I6)
924 FORMAT (20I6)
925 FORMAT (I6,I4,I6,I4,I2,I2,I3)
    END
```

INFO

```
 •                  INFO DISPLAYS THE OIL ID#, TYPE OF OIL, COMPANY FROM
 •                  WHERE IT WAS RECEIVED, ORIGIN, AND THE DATE RECEIVED
 •                  FOR THE UNWEATHERED OILS.
 •                  FOR THE WEATHERED OILS IT DISPLAYS THE ID#, AMOUNT OF
 •                  WEATHERING IN HRS., SAMPLING DATE, AIR TEMP., WATER
 •                  TEMP., WIND VELOCITY, CLOUD COVER, AND LAB CONDITIONS.
 •                  THE UNWEATHERED DATA IS STORED IN FILE IKN
 •                  THE WEATHERED DATA IS STORED IN FILES UNKA THRU UNKJ
 •                  INFORMATION IS ENTERED INTO THESE DATA FILES BY PROGRAM IDENT
      DIMENSION A(500,2),B(500,6),JA(500),JB(500),JC(1000),JD(1000),%
      JE(1000),JF(1000),JG(1000),JH(1000),JI(1000),KNUM(500)
      KFILEO = 0
 •                 READ IN THE UNWEATHERED OIL DATA FROM FILE IKN
      CALL OPEN (2,'IKN','INPUT')
      READ (2,902) I1
 •                 I1 = #NUMBER OF OILS IN FILE IKN
      DO 5 I = 1,I1
    5 READ (2,905) KNUM(I),(A(I,M),M=1,2),JA(I),(B(I,M),M=1,6),JB(I)
 •                 KNUM(I) = UNWEATHERED OIL  ID#
 •                 A(I,M) = TYPE OF OIL
 •                 JA(I) = COMPANY
 •                 JB(I,M) = DATE RECEIVED
 •                 B(I,M) = ORIGIN (COUNTRY,ETC.)
      CALL CLOSE (2)
      WRITE (6,907)
      READ (5,908) K1
      GO TO (20,40,60,80,100),K1
   20 WRITE (6,909)
      READ (5,910) KKNUM1
 •                 KKNUM1 = WEATHERED OIL ID# TO BE DISPLAYED
      IF (KKNUM1) 500,500,21
 •                 ANY GO TO 500 STATEMENT RESULTS IN A DEFAULT TO END OF PROGRAM
   21 Z = KKNUM1 + 100000
      Z = Z/100000.
      KFILE = Z
      IF (KFILE - KFILEO) 23,22,23
 •                 OPEN THE WEATHERED OIL DATA FILE WHERE KKNUM1 IS LOCATED
   23 GO TO 200
   22 IF (I2) 10,10,11
   10 WRITE (6,935)
      GO TO 20
```

INFO

```
*                   FIND CORRESPONDING INDEX NEMBER FOR KKNUM1
 11 DO 13 J = 1,I2
    IF (KKNUM1 - JC(J)) 13,15,13
 13 CONTINUE
    GO TO 10
 15 Z1 = KKNUM1
    Z1 = Z1/1000.
    IDEN = Z1
    DO 24 J = 1,I1
    IF (KNUM(J) - IDEN) 24,26,24
 24 CONTINUE
 26 GO TO 275
*                   DISPLAY THE UNWEATHERED OIL # KKNUM1 DATA AT THE TERMINAL
 27 WRITE (6,915)
    WRITE (6,916) KNUM(J),(A(J,M),M=1,2),JA(J),(B(J,M),M=1,6),JB1,JB2
    DO 29 I= 1,I2
    IF (JC(I) - KKNUM1) 29,30,29
 29 CONTINUE
 30 GO TO 300
*                   DISPLAY THE WEATHERED OIL # KKNUM1 DATA AT THE TERMINAL
 31 WRITE (6,919)
    WRITE (6,920) JC(I),JD(I),JE1,JE2,JE3,JF1,JF2,JH(I),JI(I),%
    JG4,JG5,JG6
*                   GO TO STATEMENT 20 TO READ IN MORE OILS IF ANY TO BE DISPLAYED
    GO TO 20
 40 WRITE (6,917)
    READ (5,902) KKNUM2
*                   KKNUM2 = UNWEATHERED OIL ID# FOR WHICH ALL WEATHERING
*                   DATA WILL BE DISPLAYED
    IF (KKNUM2) 500,500,41
 41 Z4 = KKNUM2 + 100
    Z4 = Z4/100.
    KFILE = Z4
    IF (KFILE - KFILEO) 42,43,42
 42 GO TO 200
 43 DO 45 I = 1,300
    IF (KNUM(I) - KKNUM2) 45,47,45
 45 CONTINUE
 47 I4 = I
    J = I
```

INFO

```
      GO TO 275
*                    DISPLAY THE UNWEATHERED OIL # KKNUM2 DATA AT THE TERMINAL
   46 WRITE (6,915)
      WRITE (6,916) KNUM(J),(A(J,M),M=1,2),JA(J),(B(J,M),M=1,6),JB1,JB2
*                    DISPLAY ALL THE WEATHERED OIL DATA FOR UNWEATHERED OIL
*                    KKNUM2 AT THE TERMINAL
      WRITE (6,919)
      DO 49 I = 1,1000
      Z5 = JC(I)
       Z5 = Z5/1000.
       J4 = Z5
       IF (KNUM(I4) - J4) 49,48,49
   48 GO TO 300
   50 WRITE (6,920) JC(I),JD(I),JE1,JE2,JE3,JF1,JF2,JH(I),JI(I),%
       JG4,JG5,JG6
   49 CONTINUE
       GO TO 500
   60 WRITE (6,923)
       JJ = 0
       READ (5,908) KFILE
 *                    KFILE = FILE # FOR ONE TYPE OF OIL
       KFILE = KFILE + 1
       JACK = 1
       GO TO 200
   62 DO 70 J = 1,I1
       KP1 = KFILE - 1
       Z3 = KNUM(J)
       Z3 = Z3/100.
       KP2 = Z3
       IF (KP2 - KP1) 70,63,500
   63 IF(JACK) 69,275,69
 *                    DISPLAY THE UNWEATHERED OIL DATA AT THE TERMINAL
   69 WRITE (6,915)
       GO TO 275
   64 WRITE (6,916) KNUM(J),(A(J,M),M=1,2),JA(J),(B(J,M),M=1,6),JB1,JB2
       JACK = 0
       DO 67 I = 1,I2
       Z4 = JC(I)
       Z4 = Z4/1000.
       JCK = Z4
```

INFO

```
      IF(KNUM(J) - JCK) 67,71,67
   71 IF(JACK) 72,72,300
   72 WRITE (6,919)
      JACK = 1
      GO TO 300
*                DISPLAY THE WEATHERED OIL DATA UNDERNEATH ITS CORRESPONDING
*                UNWEATHERED OIL DATA FOR K1 = 3 (ALL DATA ON ONE TYPE OF OIL)
   66 WRITE (6,920) JC(I),JD(I),JE1,JE2,JE3,JF1,JF2,JH(I),JI(I),%
      JG4,JG5,JG6
   67 CONTINUE
   70 CONTINUE
      GO TO 500
*                DISPLAY AT THE TERMINAL THE DATA ON ALL UNWEATHERED OILS
   80 WRITE (6,915)
      DO 90 J =1,I1
      GO TO 275
   88 WRITE (6,916) KNUM(J),(A(J,M),M=1,2),JA(J),(B(J,M),M=1,6),JB1,JB2
   90 CONTINUE
      GO TO 500
  100 JJ = 0
      JJ1 = 0
      JACK = 1
      DO 120 J = 1,I1
      IF (JACK) 275,275,112
  112 WRITE (6,915)
      GO TO 275
*                THE FOLLOWING STATEMENTS TO STATEMENT 120 DISPLAYS AT THE
*                TERMINAL ALL THE UNWEATHERED AND WEATHERED OIL DATA.  AN
*                UNWEATHERED OIL IS DISPLAYED FOLLOWED BY ALL ITS
*                CORRESPONDING WEATHERED DATA AND SO FORTH FOR EACH
*                UNWEATHERED OIL AND CORRESPONDING WEATHERING DATA.
  101 WRITE (6,916) KNUM(J),(A(J,M),M=1,2),JA(J),(B(J,M),M=1,6),JB1,JB2
      JACK = 0
      Z3 = KNUM(J) + 100
      Z3 =  Z3/100.
      KFILE = Z3
      IF (KFILE - KFILEO) 200,102,200
  102 DO 111 I = 1,I2
      Z4 = JC(I)
      Z4 = Z4/1000.
```

INFO

```
      JT = Z4
      IF (KNUM(J) - JT) 120,107,111
  107 GO TO 300
  108 IF (JJ1) 110,109,110
  109 WRITE (6,919)
  110 WRITE (6,920) JC(I),JD(I),JE1,JE2,JE3,JF1,JF2,JH(I),JI(I),%
      JG4,JG5,JG6
      JJ1 = JJ1 + 1
      JACK = 1
  111 CONTINUE
  120 JJ1 = 0
      GO TO 500
  200 JM = KFILE
      IF (JM) 260,260,205
  *                   OPEN WEATHERED OIL DATA FILES FOR INPUT
  205 GO TO (211,212,213,214,215,216,217,218,219,220),JM
  211 CALL OPEN (3,'UNKA','INPUT')
      GO TO 221
  212 CALL OPEN (3,'UNKB','INPUT')
      GO TO 221
  213 CALL OPEN (3,'UNKC','INPUT')
      GO TO 221
  214 CALL OPEN (3,'UNKD','INPUT')
      GO TO 221
  215 CALL OPEN (3,'UNKE','INPUT')
      GO TO 221
  216 CALL OPEN (3,'UNKF','INPUT')
      GO TO 221
  217 CALL OPEN (3,'UNKG','INPUT')
      GO TO 221
  218 CALL OPEN (3,'UNKH','INPUT')
      GO TO 221
  219 CALL OPEN (3,'UNKI','INPUT')
      GO TO 221
  220 CALL OPEN (3,'UNKJ','INPUT')
  221 READ (3,902) I2
  *                   I2 = NUMBER OF WEATHERED OILS IN FILE
      WRITE (6,902) I2
      IF (I2) 227,227,226
  226 DO 223 I = 1,I2
```

INFO

```
223 READ (3,912) JC(I),JD(I),JE(I),JF(I),JH(I),JI(I),JG(I)
227 KFILEO = KFILE
    •               JC(I) = WEATHERED OIL ID # (I6)
    •               JD(I) = WEATHERING HRS. (I4)
    •               JE(I) = SAMPLING DATE (I6)
    •               JF(I) = AIR AND WATER TEMP. (I4)
    •               JH(I) = WIND VELOCITY (I2)
    •               JI(I) = CLOUD COVER (I1) 1 THRU 5
    •               JG(I) = LAB CONDITIONS (I3)
    CALL CLOSE (3)
260 GO TO (22,43,62,500,102),K1
    •               STATEMENTS 275 THRU 350 REFORMATS THE DATA FOR
    •               PRINTING AT A TERMINAL FOR EACH SPECIFIC DATA DISPLAY
275 Z2 = JB(J)
    Z2 = Z2/100.
    JB1 = Z2
    JU = JB1*100
    JB2 = JB(J) - JU
    GO TO (27,46,64,88,101),K1
300 Z6 = JE(I)
    Z6 = Z6/10000.
    JE1 = Z6
    JU = JE1*10000
    Z6 = JE(I) - JU
    Z6 = Z6/100.
    JE2 = Z6
    JU = JU + JE2*100
    JE3 = JE(I) - JU
    Z6 = JF(I)
    Z6 = Z6/100.
    JF1 = Z6
    JF2 = JF(I) - JF1*100
    Z6 = JG(I)
    Z6 = Z6/100.
    JG4 = Z6
    JU = JG4*100
    Z6 = JG(I) - JU
    Z6 = Z6/10.
    JG5 = Z6
    JU = JU + JG5*10
```

INFO

```
      JG6 = JG(I) - JU
  350 GO TO (31,50,66,500,108),K1
  500 CONTINUE
*                DEFAULT TO END OF PROGRAM
  902 FORMAT (I3)
  905 FORMAT (I3,2A4,I2,6A4,I4)
  907 FORMAT (' TYPE OF INFORMATION WANTED?' / ' 01 FOR ONE'%
      ' WEATHERED OIL, 02 FOR ALL WEATHERING DATA ON ONE UNWEATHERED OIL,'%
      ' 03 FOR ALL DATA ON ONE TYPE OF OIL, 04 FOR ALL UNWEATHERED DATA,'%
      ' 05 FOR ALL DATA ON ALL WEATHERED OILS')
  908 FORMAT (I2)
  909 FORMAT (// ' IDENTIFICATION NUMBER OF WEATHERED OIL? I6 ')
  910 FORMAT (I6)
  912 FORMAT (I6,I4,I6,I4,I2,I2,I3)
  915 FORMAT (/70H KNOWN     TYPE     COMPANY              ORIGIN              DATE RECEIVED)
  916 FORMAT (1X,I3,4X,2A4,6X,I2,7X,6A4,5X,I2,1H/,I2)
  917 FORMAT (' DATA ON WEATHERING WANTED FOR UNWEATHERED OIL # ?  I3')
  919 FORMAT (55H   UNKNOWN    WEATHER    SAMPLE      TEMP      WIND    %
      13HCLOUD     LAB,/48H              TIME HRS     DATE     AIR  H20     %
      20HKPH    COVER    COND)
  920 FORMAT (4X,I6,5X,I4,5X,I2,2(1H/,I2),4X,I2,3X,I2,6X,I2,6X,I2,%
      4X,3(I1,1H,))
  923 FORMAT(16H FILE NUMBER? I2)
  935 FORMAT (' NO WEATHERED OIL BY THAT NUMBER')
      END
```

TOIL

```
*                    THIS PROGRAM WILL STORE THE % TRANSMISSIONS OF AN OIL
*                    ALONG WITH THE OILS SIX DIGIT I.D.#,WINDOW THICKNESS IF
*                    NACL, PATHLENGTH, AND %T AT 1950 AND 650 CM-1  IN ONE
*                    OF THE DATA FILES TA THRU TW.
 410 CONTINUE
     JY=0
     DIMENSION N(18),KNUM(191), J(191,18),JBASE(191),JBASE2(191),%
     BB(191),B1(191),J2(191),JKNUM(191),JJ(191,18),JJBASE(191),%
     KBASE2(191),ABB(191),AB1(191),JJ2(191),KNUMB(20),KKNUM(191),KJ(191,18),KJBASE(191),LBASE2(191),%
     CBB(191),CB1(191),KJ2(191),JJT(18)
*                   PROGRAM REQUESTS THE FILE NUMBER TO BE USED
*                   AND THE NUMBER OF OILS BEING ADDED TO IT
     WRITE (6,800)
 800 FORMAT (' FILE# ? 01-22,  # OF OILS ADDING ? I2')
     READ (5,810) J1,L1
*                   J1=FILE #
*                   L1=# OF OILS ADDING TO FILE #J1
 810 FORMAT (2I2)
*                   READ IN THE 18 FREQUENCIES FROM FILE FREQCG
     CALL OPEN (4,'FREQCG','INPUT')
     READ (4,820) (N(M),M=1,18)
 820 FORMAT (18I4)
     CALL CLOSE (4)
     KM=1
 366 CONTINUE
*                   OPEN DATA FILE #J1 FOR PROGRAM DATA INPUT
     GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23),J1
   1 CALL OPEN (2,'TA','INPUT')
     GO TO (50,300,360),KM
   2 CALL OPEN (2,'TB','INPUT')
     GO TO (50,300,360),KM
   3 CALL OPEN (2,'TC','INPUT')
     GO TO (50,300,360),KM
   4 CALL OPEN (2,'TD','INPUT')
     GO TO (50,300,360),KM
   5 CALL OPEN (2,'TE','INPUT')
     GO TO (50,300,360),KM
   6 CALL OPEN (2,'TF','INPUT')
     GO TO (50,300,360),KM
   7 CALL OPEN (2,'TG','INPUT')
     GO TO (50,300,360),KM
```

TOIL

```
    8 CALL OPEN (2,'TH','INPUT')
      GO TO (50,300,360),KM
    9 CALL OPEN (2,'TI','INPUT')
      GO TO (50,300,360),KM
   10 CALL OPEN (2,'TJ','INPUT')
      GO TO (50,300,360),KM
   11 CALL OPEN (2,'TK','INPUT')
      GO TO (50,300,360),KM
   12 CALL OPEN (2,'TL','INPUT')
      GO TO (50,300,360),KM
   13 CALL OPEN (2,'TM','INPUT')
      GO TO (50,300,360),KM
   14 CALL OPEN (2,'TN','INPUT')
      GO TO (50,300,360),KM
   15 CALL OPEN (2,'TO','INPUT')
      GO TO (50,300,360),KM
   16 CALL OPEN (2,'TP','INPUT')
      GO TO (50,300,360),KM
   17 CALL OPEN (2,'TQ','INPUT')
      GO TO (50,300,360),KM
   18 CALL OPEN (2,'TR','INPUT')
      GO TO (50,300,360),KM
   19 CALL OPEN (2,'TS','INPUT')
      GO TO (50,300,360),KM
   20 CALL OPEN (2,'TT','INPUT')
      GO TO (50,300,360),KM
   21 CALL OPEN (2,'TU','INPUT')
      GO TO (50,300,360),KM
   22 CALL OPEN (2,'TV','INPUT')
      GO TO (50,300,360),KM
   23 CALL OPEN (2,'TW','INPUT')
      GO TO (50,300,360),KM
   50 READ (2,830) I2
*                    I2=$ OF OILS ALREADY IN FILE #J1
  830 FORMAT (I3)
      IF (I2-1) 85,57,57
*                    READ INTO PROGRAM DATA ALREADY IN FILE #J1
   57 DO 60 I=1,I2
   60 READ (2,840) KNUM(I),(J(I,M),M=1,18),JBASE(I),JBASE2(I),J2(I),BB(I),B1(I)
  840 FORMAT (1X,I6,18(I2),I2,I2,I2,F5.3,F5.2)
```

```
 *                    KNUM(I)=OIL ID #, J(I,M)=%T FOR THE 18 BANDS, JBASE(I)=%T AT 650 CM-1, JBASE2(I)=%T AT 1950 CM-1
 *                    J2(I)=TYPE OF SAMPLE CELL, BB(I)=PATHLENGTH, B1(I)=THICKNESS OF WINDOWS IF NACL
      CALL CLOSE (2)
      K2=0
 *                    THE FOLLOWING STATEMENTS TO STATEMENT 80 WILL REMOVE ANY DATA FROM FILE #J1
      WRITE (6,850) J1
  850 FORMAT (' REMOVE ANY OILS FROM FILE# ',I2,/ ' NO=00, '%
      ' IF YES HOW MANY? I2 ')
      READ (5,860) K1
 *                     K1=# OF OILS TO BE REMOVED FROM FILE #J1
  860 FORMAT (I2)
      IF (K1-1) 85,81,81
   81 WRITE (6,206)
  206 FORMAT (' LIST OIL NUMBERS TO BE REMOVED I6 ')
      READ (5,865) (KNUMB(LJ),LJ=1,K1)
 *                 KNUMB(LJ)=OIL ID# TO BE REMOVED
  865 FORMAT (10I6)
   82 DO 80 L=1,K1
      DO 70 I=1,I2
      IF (KNUMB(L)-KNUM(I))95,90,95
   90 KNUM(I)=999999
      K2=K2+1
      GO TO 80
   95 CONTINUE
   70 CONTINUE
   80 CONTINUE
   85 IF (L1) 133,133,204
 *                     READ IN THE NEW DATA TO BE ADDED TO FILE #J1
  204 WRITE (6,870)
  870 FORMAT ( ' KNOWN # I6, CELL TYPE 01=NACL,02=AGCL,03=KBR'%
      ' , CELL THICKNESS F5.2 (00.00 IF NOT NACL), PATH LENGTH '%
      'F5.3,'/' %T AT 650 CM-1 I2, %T AT 1950 CM-1 I2, %T OF '%
      '18 BANDS 18I2 ')
      I3=I2+1
      I4=I3+L1
      DO 100 IT=1,L1
      I=I2+IT
  953 READ (5,880) KNUM(I),J2(I),B1(I),BB(I),JBASE(I),%
      JBASE2(I),(J(I,M),M=1,18)
      IF (I2-1) 100,955,955
```

TOIL

```
955 KCHECK=KNUM(I)
*                   COMPUTER CHECKS TO MAKE SURE AN OIL ID# HAS NOT BEEN DUPLICATED
    DO 951 IC=1,I2
    IF (KCHECK-KNUM(IC)) 951,950,951
950 WRITE (6,952)
952 FORMAT (' YOU HAVE DUPLICATED AN ID#, PLEASE RETYPE')
    GO TO 953
951 CONTINUE
100 CONTINUE
880 FORMAT ( I6,I2,F5.2,F5.3,I2,I2,18I2)
*                   DISPLAY THE NEW DATA AT THE TERMINAL TO BE VERIFIED BY THE OPERATOR AS TO ITS CORRECTNESS
    DO 110 IT=1,L1
    I=I2+IT
    WRITE (6,892) (N(M),M=1,18)
    WRITE (6,890) KNUM(I),(J(I,M),M=1,18),JBASE(I),JBASE2(I)
892 FORMAT (' FREQ.',I7,17I6)
890 FORMAT (1X,I6,18(4X,I2) / ' %T AT 650 CM-1 '%
    ,I2,5X,' %T AT 1950 CM-1 ',I2)
    WRITE (6,900)
900 FORMAT ( ' ANY ERRORS ? NO=00, IF YES HOW MANY ? I2 ')
    READ (5,894) JE
*                   JE=# OF ERRORS
894 FORMAT (I2)
    IF (JE-1) 110,112,112
112 WRITE (6,896)
896 FORMAT (' WRITE FREQUENCIES AND NEW % TRANSMISSIONS  I4,I2')
    DO 550 K=1,JE
    READ (5,898) KEF,JET
898 FORMAT (I4,I2)
    IF (KEF-650) 510,500,510
500 JBASE(I)=JET
    GO TO 550
510 IF (KEF-1950) 511,505,511
505 JBASE2(I)=JET
    CO TO 550
511 DO 545 M=1,18
    IF (N(M)-KEF) 545,512,545
512 J(I,M)=JET
    GO TO 550
545 CONTINUE
```

```
 550 CONTINUE
 110 CONTINUE
 133 CONTINUE
*                    THE FOLLOWING STATEMENTS TO STATEMENT 200 ORDERS THE DATA BY INCREASING OIL ID#
     IJ=1
     I4=I2+L1
     DO 200 I=1,I4
     II=I
     IF (I-I4) 262,220,262
 262 I5=I+1
     DO 210 KI=I5,I4
 225 IF (KNUM(I)-KNUM(KI)) 210,230,230
 230 IF (KNUM(I)-999999) 240,200,240
 240 KT=KNUM(I)
     JT=J2(I)
     BT=B1(I)
     BBT=BB(I)
     JBT=JBASE(I)
     JBT2=JBASE2(I)
     DO 241 M=1,18
 241 JJT(M)=J(I,M)
 244 KNUM(I)=KNUM(KI)
     J2(I)=J2(KI)
     B1(I)=B1(KI)
     BB(I)=BB(KI)
     JBASE(I)=JBASE(KI)
     JBASE2(I)=JBASE2(KI)
     DO 242 M=1,18
 242 J(I,M)=J(KI,M)
     KNUM(KI)=KT
     J2(KI)=JT
     B1(KI)=BT
     BB(KI)=BBT
     JBASE(KI)=JBT
     JBASE2(KI)=JBT2
     DO 249 M=1,18
 249 J(KI,M)=JJT(M)
     GO TO 225
 210 CONTINUE
 220 JKNUM(IJ)=KNUM(II)
```

TOIL

```
      JJ2(IJ)=J2(II)
      AB1(IJ)=B1(II)
      ABB(IJ)=BB(II)
      JJBASE(IJ)=JBASE(II)
      KBASE2(IJ)=JBASE2(II)
      DO 226 M=1,18
  226 JJ(IJ,M)=J(II,M)
  227 IJ=IJ+1
  200 CONTINUE
      KM=2
*                  OPEN THE DATA FILE #J1 FOR OUTPUT
      GO TO (31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,51,52,53,54),J1
   31 CALL OPEN (2,'TA','OUTPUT')
      GO TO (50,300,360),KM
   32 CALL OPEN (2,'TB','OUTPUT')
      GO TO (50,300,360),KM
   33 CALL OPEN (2,'TC','OUTPUT')
      GO TO (50,300,360),KM
   34 CALL OPEN (2,'TD','OUTPUT')
      GO TO (50,300,360),KM
   35 CALL OPEN (2,'TE','OUTPUT')
      GO TO (50,300,360),KM
   36 CALL OPEN (2,'TF','OUTPUT')
      GO TO (50,300,360),KM
   37 CALL OPEN (2,'TG','OUTPUT')
      GO TO (50,300,360),KM
   38 CALL OPEN (2,'TH','OUTPUT')
      GO TO (50,300,360),KM
   39 CALL OPEN (2,'TI','OUTPUT')
      GO TO (50,300,360),KM
   40 CALL OPEN (2,'TJ','OUTPUT')
      GO TO (50,300,360),KM
   41 CALL OPEN (2,'TK','OUTPUT')
      GO TO (50,300,360),KM
   42 CALL OPEN (2,'TL','OUTPUT')
      GO TO (50,300,360),KM
   43 CALL OPEN (2,'TM','OUTPUT')
      GO TO (50,300,360),KM
   44 CALL OPEN (2,'TN','OUTPUT')
      GO TO (50,300,360),KM
```

```
 45 CALL OPEN (2,'TO','OUTPUT')
    GO TO (50,300,360),KM
 46 CALL OPEN (2,'TP','OUTPUT')
    GO TO (50,300,360),KM
 47 CALL OPEN (2,'TQ','OUTPUT')
    GO TO (50,300,360),KM
 48 CALL OPEN (2,'TR','OUTPUT')
    GO TO (50,300,360),KM
 49 CALL OPEN (2,'TS','OUTPUT')
    GO TO (50,300,360),KM
 51 CALL OPEN (2,'TT','OUTPUT')
    GO TO (50,300,360),KM
 52 CALL OPEN (2,'TU','OUTPUT')
    GO TO (50,300,360),KM
 53 CALL OPEN (2,'TV','OUTPUT')
    GO TO (50,300,360),KM
 54 CALL OPEN (2,'TW','OUTPUT')
    GO TO (50,300,360),KM
300 CONTINUE
*                     WRITE ON FILE #J1 THE NUMBER OF OILS IT WILL CONTAIN
    I6=I2+L1-K2
    WRITE (2,830) I6
*                     I6=# OF OILS PLACING IN FILE
*                     WRITE ALL THE OIL DATA ONTO FILE #J1
    DO 400 JI=1,I6
    WRITE (2,840) JKNUM(JI),(JJ(JI,M),M=1,18),JJBASE(JI),KBASE2(JI),JJ2(JI),ABB(JI),AB1(JI)
400 CONTINUE
*                     OPTION TO DISPLAY OIL ID NUMBERS OR ALL THE DATA IN FILE #J1
    WRITE (6,910)
910 FORMAT ( ' DISPLAY THE FILE? NO=00,OIL NUMBERS ONLY=01,ALL THE DATA=02 ')
    READ (5,894) JO
    JO=JO+1
    GO TO (310,320,320),JO
320 KM=3
    GO TO 366
360 READ (2,830) I7
    DO 327 IX=1,I7
    READ (2,840) KKNUM(IX),(KJ(IX,M),M=1,18),KJBASE(IX),LBASE2(IX),KJ2(IX),CBB(IX),CB1(IX)
327 CONTINUE
    GO TO (310,340,350),JO
```

TOIL

```
340 WRITE (6,920)
    DO 345 IJ=1·I7
345 WRITE (6,925) KKNUM(IJ)
920 FORMAT ( ' OIL IDENTIFICATION # ' /)
925 FORMAT ( 3X,I6)
    GO TO 310
350 WRITE (6,892) (N(M),M=1,18)
930 FORMAT ( ' CELL TYPE,',I2,5X,' CELL THICKNESS,',F5.2,5X,' PATH LENGTH,',F5.3 / )
    DO 355 IZ=1,I7
    WRITE (6,890) KKNUM(IZ),(KJ(IZ,M),M=1,18),KJBASE(IZ),LBASE2(IZ)
    WRITE (6,930) KJ2(IZ),CB1(IZ),CBB(IZ)
355 CONTINUE
310 CONTINUE
    CALL CLOSE (2)
*             OPTION TO RUN PROGRAM AGAIN
    WRITE (6,903)
903 FORMAT (' DO YOU WISH TO RUN AGAIN? NO=00,YES=01')
    READ (5,894) JY
    IF (JY-1) 420,410,420
420 CONTINUE
    END
```

SEARCH

```
*
*        % TRANSMISSIONS FOR AN OIL CAN BE TYPED INTO THIS PROGRAM OR CALLED IN FROM
*        FROM ANY ONE OF THE SPECTRAL DATA FILES.  THE SPECTRAL DATA FOR THIS OIL
*        ARE THEN COMPARED TO THOSE DATA FROM ANY ON OF THE 23 DATA FILES; TA, TB, ....TC.
*        % TRANSMISSION DATA FOR ALL OILS ARE CONVERTED TO ABSORPTIVITIES AND COMPARED
*        BY THE RATIO METHOD.
*
*
*        ..............................................................................
*
      IM = 0
      DIMENSION N(18)
*
*        READS THE 18 FREQUENCIES FROM FILE FREQ.
*
      CALL OPEN (4,'FREQCG','INPUT')
      READ (4,903) (N(M),M=1,18)
      CALL CLOSE (4)
*
*        DEFINES COEFFICIENTS FOR CUBIC EQUATION USED TO DETERMINE BASELINE FOR NACL CELLS
*
      A0=0.57966858E-02
      A1=0.33685763E-04
      A2=-0.47562509E-06
      A3=0.37389647E-08
  960 CONTINUE
      DIMENSION AA(18),JUJ(18),KNUM(200),BB(200),B1(200),J2(200),JBASE(200),%
      JBASE2(200),JJ(200,18),AK(200),BDD(200),K2(200),K3(200),K4(200),PHI(200),BC(200,18),BBC(200),%
      JB(10)
*
*        ASK FOR DATA ON OIL TO BE COMPARED; OPTION TO TYPE IN OR CALL FROM FILE.
*
      WRITE(6,800)
  800 FORMAT ( ' RUN AN OIL ALREADY IN FILE ?,01  OR ENTER AN OIL ?,02 ')
      READ (5,801) LM
  801 FORMAT ( I2)
      GO TO (802,803),LM
*
*        FINDS DATA ON OIL IN APPROPRIATE FILE
*
  802 WRITE (6,804)
```

SEARCH

```
804 FORMAT ( ' FILE # I2, OIL IDENTIFICATION # I6 ')
    READ (5,805) J1,NUMX
805 FORMAT (I2,I6)
    KM=2
    IF (JJ1-J1) 806,555,806
300 READ (2,911) I2X
    DO 810 IX=1,I2X
810 READ (2,912) KNUM(IX),(JJ(IX,M),M=1,18),JBASE(IX),JBASE2(IX),J2(IX),BB(IX),B1(IX)
    CALL CLOSE (2)
555 CONTINUE
    DO 815 JX=1,I2X
    IF (NUMX-KNUM(JX)) 815,820,815
820 JNUM=KNUM(JX)
    J4=J2(JX)
    UB1=B1(JX)
    UBB=BB(JX)
    J1BASE=JBASE(JX)
    J2BASE=JBASE2(JX)
    DO 821 M=1,18
821 JUJ(M)=JJ(JX,M)
    GO TO 830
815 CONTINUE
    GO TO 830
*
*         READS IN DATA FROM TERMINAL
*
803 WRITE (6,901)
901 FORMAT ( ' UNKNOWN# I6, CELL TYPE 01-NACL,02-AGCL,03-KBR, CELL THICKNESS F5.0(00.00 IF NOT NACL)'%
    ' , PATH LENGTH F5.0' / ' %T AT 650 CM-1, %T AT 1950 CM-1, %T OF 18 BANDS ')
    READ (5,902) JNUM,J4,UB1,UBB,J1BASE,J2BASE,(JUJ(M),M=1,18)
902 FORMAT ( I6,I2,2F5.0,I2,I2,18I2)
830 CONTINUE
903 FORMAT (18I4)
    WRITE (6,904) (N(M),M=1,18)
904 FORMAT (' FREQ. ',18I6)
    WRITE (6,905) JNUM,(JUJ(M),M=1,18)
    WRITE (6,993) J1BASE,J2BASE
993 FORMAT ( ' %T AT 650   ',I2,5X,' %T AT 1950  ',I2)
905 FORMAT (1X,I6,18I6)
*
```

```
•          CORRECTS % TRANSMISSIONS IF NECESSARY
•
      WRITE (6,906)
  906 FORMAT (' LIST NUMBER OF TRANSMISSIONS TO BE CHANGED, I2 ')
      READ (5,801) JE
      IF (JE) 42,26,42
   42 WRITE (6,907)
  907 FORMAT ( ' WRITE FREQUENCIES AND NEW % TRANSMISSIONS, I4,I2 ')
      DO 30 I=1,JE
       READ (5,908) KEF,JET
  908 FORMAT ( I4,I2)
       IF (650-KEF) 994,995,994
  995 J1BASE=JET
       GO TO 30
  994 IF (1950-KEF) 996,997,996
  997 J2BASE=JET
       GO TO 30
  996 CONTINUE
       DO 40 M=1,18
       IF (N(M)-KEF) 40,60,40
   40 CONTINUE
   60 JUJ(M)=JET
       GO TO 30
   52 CONTINUE
   30 CONTINUE
       GO TO 830
•
•          CALCULATION OF ABSORPTIVITIES FOR OIL TO BE COMPARED
•
   26 CONTINUE
       BASE=J1BASE
       BASE2=J2BASE
       V1=650.
  931 FORMAT (4E20.8)
•
•          IF NACL CELLS (J4 = 1), BASELINE WILL BE CORRECTED.
•          THE FINAL VALUE OF C1 = IO/I FOR THE NACL CELL AT 650 CM-1.
•
       GO TO (80,71,71),J4
   80  C1=A0+A1*170.+A2*170.**2+A3*170.**3
```

SEARCH

```
     C1=C1*UB1
     C1=10**C1
     F1=820.
     GO TO 25
*
*          THE FOLLOWING STATEMENTS MAKE A LINEAR BASELINE FROM 1950 TO 650 CM-1.
*
  71 IF (J2BASE-J1BASE) 75,72,75
  72 JUPE=3
     GO TO 73
  74 V2=1200.
     GO TO 76
  75 V2 = 1950.
  76 W1=(BASE*V2-BASE2*V1)/(V2-V1)
     W2=((BASE2-BASE)*V1)/(V1*V2-V1**2)
     JUPE=2
  73 F1=100.
     C1=1.
  25 XX=J1BASE
     XX=XX*C1
     DO 45 M=1,18
     F=N(M)
     F=F1-F
     IF (F1-820.) 35,28,35
  28 IF (F) 31,29,29
*
*          IN THE NEXT THREE EQUATIONS THE IO/I (=C2) FOR NACL IS CALCULATED FOR EACH
*          OF THE FREQUENCIES BELOW 810 CM-1
*
  29 C2=A0+A1*F+A2*F**2+A3*F**3
     C2=C2*UB1
     C2=10**C2
*
*          FOR NACL XX = IO/I X I = IO  (CALCULATED AT 650 CM-1)
*                   X = IO/IO/I = I, WHICH THEN BECOMES THE IO BASELINE FOR NACL
*
  31 X=XX/C2
     GO TO 33
  35 F=F1-F
     GO TO (38,38,39),JUPE
```

SEARCH

```
*
*          THE FOLLOWING X IS IO FOR CELLS OTHER THAN NACL
*
   38 X=W1+W2*F
      GO TO 33
   39 X=XX
*
*          Z = OBSERVED % TRANSMITTANCES FOR THE BANDS.
*
   33 Z=JUJ(M)
      IF (JUJ(M))36,36,77
   77 AA(M)=ALOG10(X/Z)
*
*          AA(M) = ABSORPTIVITIES OF OIL TO BE COMPARED
*
      AA(M)=AA(M)/UBB
      GO TO 45
   36 AA(M)=0.0
   45 CONTINUE
      KM=1
      JUPE=0
      WRITE (6,909)
*
*          THE FILE CONTAINING DATA TO BE COMPARED IS SELECTED AND THE DATA RETRIEVED.
*
  909 FORMAT ( ' FILE# TO BE SEARCHED,01-22')
      READ (5,910) JJ1
      IF (JJ1-J1) 540,542,540
  542 I2=I2X
      GO TO 541
  540 J1=JJ1
  910 FORMAT (I2)
  806 GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23),J1
    1 CALL OPEN (2,'TA','INPUT')
      GO TO (50,300,360),KM
    2 CALL OPEN (2,'TB','INPUT')
      GO TO (50,300,360),KM
    3 CALL OPEN (2,'TC','INPUT')
      GO TO (50,300,360),KM
    4 CALL OPEN (2,'TD','INPUT')
```

SEARCH

```
      GO TO (50,300,360),KM
    5 CALL OPEN (2,'TE','INPUT')
      GO TO (50,300,360),KM
    6 CALL OPEN (2,'TF','INPUT')
      GO TO (50,300,360),KM
    7 CALL OPEN (2,'TG','INPUT')
      GO TO (50,300,360),KM
    8 CALL OPEN (2,'TH','INPUT')
      GO TO (50,300,360),KM
    9 CALL OPEN (2,'TI','INPUT')
      GO TO (50,300,360),KM
   10 CALL OPEN (2,'TJ','INPUT')
      GO TO (50,300,360),KM
   11 CALL OPEN (2,'TK','INPUT')
      GO TO (50,300,360),KM
   12 CALL OPEN (2,'TL','INPUT')
      GO TO (50,300,360),KM
   13 CALL OPEN (2,'TM','INPUT')
      GO TO (50,300,360),KM
   14 CALL OPEN (2,'TN','INPUT')
      GO TO (50,300,360),KM
   15 CALL OPEN (2,'TO','INPUT')
      GO TO (50,300,360),KM
   16 CALL OPEN (2,'TP','INPUT')
      GO TO (50,300,360),KM
   17 CALL OPEN (2,'TQ','INPUT')
      GO TO (50,300,360),KM
   18 CALL OPEN (2,'TR','INPUT')
      GO TO (50,300,360),KM
   19 CALL OPEN (2,'TS','INPUT')
      GO TO (50,300,360),KM
   20 CALL OPEN (2,'TT','INPUT')
      GO TO (50,300,360),KM
   21 CALL OPEN (2,'TU','INPUT')
      GO TO (50,300,360),KM
   22 CALL OPEN (2,'TV','INPUT')
      GO TO (50,300,360),KM
   23 CALL OPEN (2,'TW','INPUT')
      GO TO ( 50,300,360),KM
   50 CONTINUE
```

SEARCH

```
2510       READ (2,911) I2
2520   911 FORMAT (I3)
2530 *
2540 *           READS DATA FROM SELECTED FILE
2550 *
2560       DO 100 I=1,I2
2570   100 READ (2,912) KNUM(I),(JJ(I,M),M=1,18),JBASE(I),JBASE2(I),J2(I),BB(I),B1(I)
2580   912 FORMAT (1X,I6,18(I2),I2,I2,I2,F5.3,F5.2)
2590       CALL CLOSE (2)
2600   541 CONTINUE
2610       WRITE (6,430)
2620 *
2630 *           OPTION TO SCAN ALL OILS OR ONLY WEATHERED OILS OF SAMPLE BEING COMPARED.
2640 *
2650   430 FORMAT (' SCAN ONLY CORRESPONDING WEATHERED OILS? 00-NO,01-YES')
2660       READ (5,910) JW
2670       DO 200 I=1,I2
2680       IF (JW-1) 431,1000,431
2690  1000 IF ((KNUM(I)/1000)-(JNUM/1000)) 200,431,200
2700   431 J2K=J2(I)
2710       BASEK=JBASE(I)
2720       BASE2K=JBASE2(I)
2730 *
2740 *           ABSORPTIVITIES OF EACH OIL IN FILE ARE CALCULATED FROM LINE XX TO XXX IN THE SAME
2750 *           MANNER AS THOSE CALCULATED FOR THE COMPARISON OIL IN LINES 1680-ZZZ.
2760 *
2770       GO TO (180,121,121),J2K
2780   180 CK=A0+A1*170.+A2*170.**2+A3*170**3
2790       CK=CK*B1(I)
2800       CK=10**CK
2810       F1=820.
2820       GO TO 125
2830   121 IF (JBASE2(I)-JBASE(I)) 114,111,114
2840   111 JUFEK=3
2850       GO TO 122
2860   119 V2=1200.
2870       GO TO 112
2880   114 V2=1950.
2890   112 W1K=(BASEK*V2-BASE2K*V1)/(V2-V1)
2900       W2K=((BASE2K-BASEK)*V1)/(V1*V2-V1**2)
```

SEARCH

```
      JUPEK=2
  122 F1=100.
      CK=1.
  125 XX=JBASE(I)
      XX=XX*CK
      DO 145 M=1,18
      F=N(M)
      F=F1-F
      IF (F1-820.) 135,128,135
  128 IF (F) 131,129,129
  129 C2K=A0+A1*F+A2*F**2+A3*F**3
      C2K=C2K*B1(I)
      C2K=10**C2K
  131 X=XX/C2K
      GO TO 133
  135 F=F1-F
      GO TO (138,138,139),JUPEK
  138 X=W1K+W2K*F
      GO TO 133
  139 X=XX
  133 ZK=JJ(I,M)
      IF (JJ(I,M)) 136,136,78
   78 AK(M)=ALOG10(X/ZK)
      AK(M)=AK(M)/BB(I)
      GO TO 145
  136 AK(M)=0.0
  145 CONTINUE
*
*           ABSORPTIVITIES OF EACH OIL IN FILE ARE NOW CALCULATED (AK(M)).
*           NEXT, THE LOG-RATIO METHOD IS APPLIED.
*
      BBC(I)=0.0
      DO 285 M=1,18
      IF (AK(M)) 283,283,280
  280 IF (AA(M)) 283,283,281
*
*           LOG-RATIOS BC(I,M) ARE CALCULATED
*
  281 BC(I,M)=ALOG10(AA(M)/AK(M))
      BBC(I)=BBC(I)+BC(I,M)
```

```
3310       GO TO 285
3320   283 BC(I,M)=9.999
3330   285 CONTINUE
3340 *
3350 *           AVERAGE LOG RATIO BBC(I) IS CALCULATED.
3360 *
3370       BBC(I) = BBC(I)/18.
3380       BDD(I) = 0.0
3390       DO 488 M=1,18
3400       IF (BC(I,M)-9.999) 489,488,489
3410 *
3420 *           LOG-RATIO MINUS AVERAGE LOG-RATIO CALCULATED = BC(I,M)
3430 *
3440   489 BC(I,M)=BC(I,M)-BBC(I)
3450 *
3460 *           SUM OF SQUARES BDD(I) CALCULATED
3470 *
3480       BDD(I) = BC(I,M)**2 + BDD(I)
3490   488 CONTINUE
3500   495 CONTINUE
3510 *
3520 *           NUMBER OF LOG-RATIOS WITHIN 0.025 (K2(I)), 0.04 (K3(I)) AND
3530 *           0.10 (K4(I)) ARE CALCULATED IN LINES 3550-3700
3540 *
3550       K2(I)=0
3560       K3(I)=0
3570       K4(I)=0
3580       DO 410 M=1,18
3590       G=BC(I,M)
3600       IF (G) 497,498,498
3610   497 G=-G
3620   498 IF (G-0.025) 499,499,500
3630   499 K2(I)=K2(I)+1
3640       GO TO 410
3650   500 IF (G-0.040) 501,501,502
3660   501 K3(I)=K3(I)+1
3670       GO TO 410
3680   502 IF (G-0.100) 503,503,410
3690   503 K4(I)=K4(I)+1
3700   410 CONTINUE
```

```
 409 CONTINUE
•
•          PROBABILITY CALCULATION IN FOLLOWING STEPS
•          ................................................................
•          BBD(I) CONVERTED TO F-STATISTIC
•
     F = BDD(I)*3.49
     CCC = (0.75*3.14**.5)**2
     CCC = 48./CCC
     F = F**.5
     TTT = ATAN(F)
•
•          PHI(I) = 1.0 MINUS CUMULATIVE DISTIRBUTION OF F FROM 0.0 TO F (OR S2')
•
     PHI(I) = 1. - CCC*((-F)/(6.*(1.+F**2)**3) + (1./6.)*(0.25*F/((1.+F**2)**2)%
     + 0.75*(F/(2.*(1.+F**2)) + 0.5*TTT)) + F/(8*(1.+F**2)**4) - (1./8.)*%
     ((1./6.)*F/((1.+F**2)**3) + (5./6.)*(0.25*F/((1.+F**2)**2)%
     + 0.75*(0.5*F/(1.+F**2) + 0.5*TTT))))
     K3(I) = K3(I)+K2(I)
 415 K4(I)=K4(I)+K3(I)
 200 CONTINUE
     JLD = 0
     IF(JLD-1) 980,760,760
•
•          RATIOS WITHIN LIMITS, SUM OF SQUARES, AND PROBABILITY PRINTED
•
 980 WRITE (6,913)
 913 FORMAT (// ' KNUM ',5X,' NUMBER OF RATIOS WITHIN LIMITS- '/ 14X,'  0.025',5X,'  0.040',%
     5X,'  0.100',7X,'S**2',3X,'PROBABILITY'/)
     DO 432 I=1,I2
     IF (JW-1) 420,963,963
 963 KW=(KNUM(I)/1000)
     JXNUM=JNUM/1000
     IF (JXNUM-KW) 432,420,432
 420 WRITE (6,914) KNUM(I),K2(I),K3(I),K4(I),BDD(I),PHI(I)
 914 FORMAT (1X,I6,11X,I3,9X,I3,9X,I3,5X,F7.5,4X,F7.5)
 432 CONTINUE
     GO TO 760
 760 WRITE (6,921)
 921 FORMAT (//' DO YOU WANT TO DISPLAY LOG-RATIOS?  NO = 00, YES = 01 ')
```

SEARCH

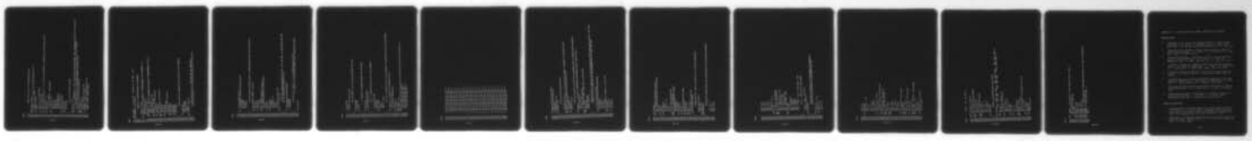
```
      READ (5,801) JP
      IF (JP) 600,600,780
 780  WRITE (6,781)
 781  FORMAT (// ' HOW MANY RATIOS LISTED? I3, IF 100 ALL WILL BE LISTED ')
      READ (5,782) J1
 782  FORMAT (I3)
      IF (100-J1) 784,783,890
 890  WRITE (6,891)
 891  FORMAT (' LIST NUMBER OF EACH 10I6 ')
 892  FORMAT (10I6)
      READ (5,892) (JB(I),I=1,J1)
      GO TO 767
 783  WRITE (6,791) (N(M),M=1,18)
      WRITE (6,792)
      GO TO 784
 785  GO TO 786
 784  DO 787 I=1,I2
      IF (JW-1) 1005,1010,1005
1010  IF ((KNUM(I)/1000)-(JNUM/1000)) 787,1005,787
1005  WRITE (6,973) KNUM(I),(BC(I,M),M=1,18)
 787  CONTINUE
      GO TO 600
 767  WRITE (6,791) (N(M),M=1,18)
 791  FORMAT (/// ' LOG-RATIO OF KNOWN TO UNKNOWN ABSORPTIVITIES.'/' FREQ.',1X,18I6)
      WRITE (6,792)
 792  FORMAT (' KNUM')
 786  DO 730 I=1,J1
      DO 729 J=1,I2
      IF (KNUM(J)-JB(I)) 729,794,729
 794  WRITE (6,973) KNUM(J),(BC(J,M),M=1,18)
      GO TO 730
 729  CONTINUE
 730  CONTINUE
 600  CONTINUE
      J22=0
      WRITE (6,950)
 950  FORMAT (//' DO YOU WISH TO RUN AGAIN? 00-NO, 01-YES ')
      READ (5,801) JY
      IF (JY) 360,360,960
 360  CONTINUE
 973  FORMAT (1X,I6,18F6.2)
      END
```

COCO

```
*
*          % TRANSMISSIONS FOR AN OIL CAN BE TYPED INTO THIS PROGRAM OR CALLED IN FROM
*          FROM ANY ONE OF THE SPECTRAL DATA FILES.  THE SPECTRAL DATA FOR THIS OIL
*          ARE THEN COMPARED TO THOSE DATA FROM ANY ON OF THE 23 DATA FILES; TA, TB, ....TC.
*          % TRANSMISSION DATA FOR ALL OILS ARE CONVERTED TO ABSORPTIVITIES AND COMPARED
*          BY CORRELATION COEFFICIENTS.
*          THE OILS FROM THE SELECTED FILE ARE ORDERED BY DECREASING CORRELATION
*          COEFFICIENTS AND LISTED.
*
*
*          ..............................................................................
*
      IM = 0
      DIMENSION N(18)
*
*          READS THE 18 FREQUENCIES FROM FILE FREQ.
*
      CALL OPEN (4,'FREQCG','INPUT')
      READ (4,903) (N(M),M=1,18)
      CALL CLOSE (4)
*
*          DEFINES COEFFICIENTS FOR CUBIC EQUATION USED TO DETERMINE BASELINE FOR NACL CELLS
*
      A0=0.57966858E-02
      A1=0.33685763E-04
      A2=-0.47562509E-06
      A3=0.37389647E-08
  960 CONTINUE
      I? = 0
      JüKER = 0
      DIMENSION AA(18),JUJ(18),KNUM(200),BB(200),B1(200),J2(200),JBASE(200),%
      JBASE2(200),JJ(200,18),AK(200),BDD(200),K2(200),K3(200),K4(200),PHI(200),BC(200,18),BBC(200),%
      JB(10),R(200),BCCD(200),K1(200)
*
*          ASK FOR DATA ON OIL TO BE COMPARED; OPTION TO TYPE IN OR CALL FROM FILE.
*
      WRITE(6,800)
  800 FORMAT ( ' RUN AN OIL ALREADY IN FILE ?,01  OR ENTER AN OIL ?,02 ')
      READ (5,801) LM
      GO TO (802,803),LM
*
```

AD-A040 975 RHODE ISLAND UNIV KINGSTON DEPT OF CHEMISTRY F/G 17/5
IDENTIFICATION OF OIL SLICKS BY INFRARED SPECTROSCOPY.(U)
AUG 76 C W BROWN, P F LYNCH, M AHMADJIAN DOT-CG-81-74-1099
UNCLASSIFIED USCG-D-19-77 NL

4 OF 4
AD
A040975



END
DATE
FILMED
7-77

COCO

```
*          FINDS DATA ON OIL IN APPROPRIATE FILE
*
 802 WRITE (6,804)
 804 FORMAT ( ' FILE # I2, OIL IDENTIFICATION # I6 ')
     READ (5,805) J1,NUMX
 805 FORMAT (I2,I6)
     KM=2
     IF (JJ1-J1) 806,555,806
 300 READ (2,911) I2X
     DO 810 IX=1,I2X
 810 READ (2,912) KNUM(IX),(JJ(IX,M),M=1,18),JBASE(IX),JBASE2(IX),J2(IX),BB(IX),B1(IX)
     CALL CLOSE (2)
 555 CONTINUE
     DO 815 JX=1,I2X
     IF (NUMX-KNUM(JX)) 815,820,815
 820 JNUM=KNUM(JX)
     J4=J2(JX)
     UB1=B1(JX)
     UBB=BB(JX)
     J1BASE=JBASE(JX)
     J2BASE=JBASE2(JX)
     DO 821 M=1,18
 821 JUJ(M)=JJ(JX,M)
     GO TO 830
 815 CONTINUE
     GO TO 830
*
*          READS IN DATA FROM TERMINAL
*
 803 WRITE (6,901)
 901 FORMAT ( ' UNKNOWN# I6, CELL TYPE 01-NACL,02-AGCL,03-KBR, CELL THICKNESS F5.0(00.00 IF NOT NACL)'%
     ' , PATH LENGTH F5.0' / ' %T AT 650 CM-1, %T AT 1950 CM-1, %T OF 18 BANDS ')
     READ (5,902) JNUM,J4,UB1,UBB,J1BASE,J2BASE,(JUJ(M),M=1,18)
 902 FORMAT ( I6,I2,2F5.0,I2,I2,21I2)
 830  CONTINUE
 903 FORMAT (21I4)
     WRITE (6,904) (N(M),M=1,18)
 904 FORMAT (' FREQ. ',18I6)
     WRITE (6,905) JNUM,(JUJ(M),M=1,18)
     WRITE (6,993) J1BASE,J2BASE
```

COCO

```
993 FORMAT ( ' %T AT 650  ',I2,5X,' %T AT 1950  ',I2)
905 FORMAT (1X,I6,18I6)
*
*          CORRECTS % TRANSMISSIONS IF NECESSARY
*
    WRITE (6,906)
906 FORMAT (' LIST NUMBER OF TRANSMISSIONS TO BE CHANGED, I2 ')
    READ (5,801) JE
    IF (JE) 42,26,42
 42 WRITE (6,907)
907 FORMAT ( ' WRITE FREQUENCIES AND NEW % TRANSMISSIONS, I4,I2 ')
    DO 30 I=1,JE
    READ (5,908) KEF,JET
908 FORMAT ( I4,I2)
    IF (650-KEF) 994,995,994
995 J1BASE=JET
    GO TO 30
994 IF (1950-KEF) 996,997,996
997 J2BASE=JET
    GO TO 30
996 CONTINUE
    DO 40 M=1,18
    IF (N(M)-KEF) 40,60,40
 40 CONTINUE
 60 JUJ(M)=JET
    GO TO 30
 52 CONTINUE
 30 CONTINUE
    GO TO 830
*
*          CALCULATION OF ABSORPTIVITIES FOR OIL TO BE COMPARED
*
 26 CONTINUE
    BASE=J1BASE
    BASE2=J2BASE
    V1=650.
931 FORMAT (4E20.8)
*
*          IF NACL CELLS (J4 = 1), BASELINE WILL BE CORRECTED.
*          THE FINAL VALUE OF C1 = I0/I FOR THE NACL CELL AT 650 CM-1.
```

COCO

```
*
      GO TO (80,71,71),J4
 80   C1=A0+A1*170.+A2*170.**2+A3*170.**3
      C1=C1*UB1
      C1=10**C1
      F1=820.
      GO TO 25
*
*            THE FOLLOWING STATEMENTS MAKE A LINEAR BASELINE FROM 1950 TO 650 CM-1.
*
   71 IF (J2BASE-J1BASE) 75,72,75
   72 JUPE=3
      GO TO 73
   74 V2=1200.
      GO TO 76
   75 V2 = 1950.
   76 W1=(BASE*V2-BASE2*V1)/(V2-V1)
      W2=((BASE2-BASE)*V1)/(V1*V2-V1**2)
      JUPE=2
   73 F1=100.
      C1=1.
   25 XX=J1BASE
      XX=XX*C1
      DO 45 M=1,18
      F=N(M)
      F=F1-F
      IF (F1-820.) 35,28,35
   28 IF (F) 31,29,29
*
*            IN THE NEXT THREE EQUATIONS THE IO/I (=C2) FOR NACL IS CALCULATED FOR EACH
*            OF THE FREQUENCIES BELOW 810 CM-1
*
   29 C2=A0+A1*F+A2*F**2+A3*F**3
      C2=C2*UB1
      C2=10**C2
*
*            FOR NACL XX = IO/I X I = IO  (CALCULATED AT 650 CM-1)
*                   X = IO/IO/I = I, WHICH THEN BECOMES THE IO BASELINE FOR NACL
*
   31 X=XX/C2
```

COCO

```
      GO TO 33
   35 F=F1-F
      GO TO (38,38,39),JUPE
*
*           THW FOLLOWING X IS IO FOR CELLS OTHER THAN NACL
*
   38 X=W1+W2*F
      GO TO 33
   39 X=XX
*
*           Z = OBSERVED % TRANSMITTANCES FOR THE BANDS.
*
   33 Z=JUJ(M)
      IF (JUJ(M))36,36,77
   77 AA(M)=ALOG10(X/Z)
*
*           AA(M) = ABSORPTIVITIES OF OIL TO BE COMPARED
*
      AA(M)=AA(M)/UBB
      GO TO 45
   36 AA(M)=0.0
   45 CONTINUE
      KM=1
      JUPE=0
      WRITE (6,909)
*
*           THE FILE CONTAINING DATA TO BE COMPARED IS SELECTED AND THE DATA RETRIEVED.
*
  909 FORMAT ( ' FILE# TO BE SEARCHED,01-22')
      READ (5,910) JJ1
      IF (JJ1-J1) 540,542,540
  542 I2=I2X
      GO TO 541
  540 J1=JJ1
  910 FORMAT (I2)
  806 GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23),J1
    1 CALL OPEN (2,'TA','INPUT')
      GO TO (50,300,360),KM
    2 CALL OPEN (2,'TB','INPUT')
      GO TO (50,300,360),KM
```

COCO

```
    3 CALL OPEN (2,'TC','INPUT')
      GO TO (50,300,360),KM
    4 CALL OPEN (2,'TD','INPUT')
      GO TO (50,300,360),KM
    5 CALL OPEN (2,'TE','INPUT')
      GO TO (50,300,360),KM
    6 CALL OPEN (2,'TF','INPUT')
      GO TO (50,300,360),KM
    7 CALL OPEN (2,'TG','INPUT')
      GO TO (50,300,360),KM
    8 CALL OPEN (2,'TH','INPUT')
      GO TO (50,300,360),KM
    9 CALL OPEN (2,'TI','INPUT')
      GO TO (50,300,360),KM
   10 CALL OPEN (2,'TJ','INPUT')
      GO TO (50,300,360),KM
   11 CALL OPEN (2,'TK','INPUT')
      GO TO (50,300,360),KM
   12 CALL OPEN (2,'TL','INPUT')
      GO TO (50,300,360),KM
   13 CALL OPEN (2,'TM','INPUT')
      GO TO (50,300,360),KM
   14 CALL OPEN (2,'TN','INPUT')
      GO TO (50,300,360),KM
   15 CALL OPEN (2,'TO','INPUT')
      GO TO (50,300,360),KM
   16 CALL OPEN (2,'TP','INPUT')
      GO TO (50,300,360),KM
   17 CALL OPEN (2,'TQ','INPUT')
      GO TO (50,300,360),KM
   18 CALL OPEN (2,'TR','INPUT')
      GO TO (50,300,360),KM
   19 CALL OPEN (2,'TS','INPUT')
      GO TO (50,300,360),KM
   20 CALL OPEN (2,'TT','INPUT')
      GO TO (50,300,360),KM
   21 CALL OPEN (2,'TU','INPUT')
      GO TO (50,300,360),KM
   22 CALL OPEN (2,'TV','INPUT')
      GO TO (50,300,360),KM
```

COCO

```
2510   23 CALL OPEN (2,'TW','INPUT')
2520      GO TO ( 50,300,360),KM
2530   50 CONTINUE
2540      READ (2,911) I2
2550  911 FORMAT (I3)
2560 *
2570 *          READS DATA FROM SELECTED FILE
2580 *
2590      DO 100 I=1,I2
2600  100 READ (2,912) KNUM(I),(JJ(I,M),M=1,18),JBASE(I),JBASE2(I),J2(I),BB(I),B1(I)
2610  912 FORMAT (1X,I6,18(I2),I2,I2,I2,F5.3,F5.2)
2620      CALL CLOSE (2)
2630  541 CONTINUE
2640      WRITE (6,430)
2650 *
2660 *          OPTION TO SCAN ALL OILS OR ONLY WEATHERED OILS OF SAMPLE BEING COMPARED.
2670 *
2680  430 FORMAT (' SCAN ONLY CORRESPONDING WEATHERED OILS? 00-NO,01-YES')
2690      READ (5,910) JW
2700      DO 200 I=1,I2
2710      IF (JW-1) 431,1000,431
2720 1000 IF ((KNUM(I)/1000)-(JNUM/1000)) 200,431,200
2730  431 J2K=J2(I)
2740      BASEK=JBASE(I)
2750      BASE2K=JBASE2(I)
2760 *
2770 *          ABSORPTIVITIES OF EACH OIL IN FILE ARE CALCULATED FROM LINE 1200 TO 1950 IN THE SAME
2780 *          MANNER AS THOSE CALCULATED FOR THE COMPARISON OIL IN LINES 2800-3230.
2790 *
2800      GO TO (180,121,121),J2K
2810  180 CK=A0+A1*170.+A2*170.**2+A3*170**3
2820      CK=CK*B1(I)
2830      CK=10**CK
2840      F1=820.
2850      GO TO 125
2860  121 IF (JBASE2(I)-JBASE(I)) 114,111,114
2870  111 JUPEK=3
2880      GO TO 122
2890  119 V2=1200.
2900      GO TO 112
```

COCO

```
114 V2=1950.
112 W1K=(BASEK*V2-BASE2K*V1)/(V2-V1)
    W2K=((BASE2K-BASEK)*V1)/(V1*V2-V1**2)
    JUPEK=2
122 F1=100.
    CK=1.
125 XX=JBASE(I)
    XX=XX*CK
    DO 145 M=1,18
    F=N(M)
    F=F1-F
    IF (F1-820.) 135,128,135
128 IF (F) 131,129,129
129 C2K=A0+A1*F+A2*F**2+A3*F**3
    C2K=C2K*B1(I)
    C2K=10**C2K
131 X=XX/C2K
    GO TO 133
135 F=F1-F
    GO TO (138,138,139),JUPEK
138 X=W1K+W2K*F
    GO TO 133
139 X=XX
133 ZK=JJ(I,M)
    IF (JJ(I,M)) 136,136,78
 78 AK(M)=ALOG10(X/ZK)
*
*          ABSORPTIVITIES  (AK(M)) OF EACH OIL IN FILE ARE CALCULATED
*
    AK(M)=AK(M)/BB(I)
    GO TO 145
136 AK(M)=0.0
145 CONTINUE
*
*          CORRELATION COEFFICIENTS ARE CALCULATED IN THE FOLLOWING STATEMENTS
*
    I9 = I9 + 1
    K10 = 0
    CO1 = 0.0
    CO2 = 0.0
```

```
3310      C03 = 0.0
3320      C04 = 0.0
3330      C05 = 0.0
3340      C06 = 0.0
3350      C07 = 0.0
3360      C08 = 0.0
3370      R(I9) = 0.0
3380      DO 285 M1 = 1,18
3390  279 M = M1
3400      IF (AK(M)) 285,285,280
3410  280 IF (AA(M)) 295,285,281
3420  281 K10 = K10 + 1
3430      C01 = AK(M)*AA(M) + C01
3440      C02 = AK(M) + C02
3450      C03 = AA(M) + C03
3460      C04 = AK(M)**2 + C04
3470      C05 = AA(M)**2 + C05
3480  285 CONTINUE
3490      F = K10
3500      C06 = C02*C03/F
3510      C07 = C02**2
3520      C07 = C07/F
3530      C08 = C03**2
3540      C08 = C08/F
3550      R(I9) = SQRT ((C04 - C07)*(C05 - C08))
3560 *
3570 *          R(I9) = CORRELATION COEFFICIENT
3580 *
3590      R(I9) = (C01 - C06)/R(I9)
3600      K1(I9) = KNUM(I)
3610  200 CONTINUE
3620 *
3630 *          OILS FROM THE SELECTED FILE ARE ORDERED BY DECREASING
3640 *          CORRELATION COEFFICIENTS IN STATEMENTS 3660-4240
3650 *
3660  434 I4 = I9
3670      DO 750 I = 1,I4
3680  750 K3(I) = I
3690      I = I + 1
3700      K3(I) = 0
```

COCO

```
      JJJ = 0
      IJ3 = I4
  699 CONTINUE
      DO 700 I = 1,I4
      IJ12 = 0
      IJ7 = I
      IJ6 = 0
      IJ1 = K3(I)
      BCD = R(IJ1)
      IJ2 = I + 1
  701 DO 720 IJ = IJ2,IJ3
      IJ4 = K3(IJ)
      IF (BCD - R(IJ4)) 705,710,710
  705 IJ5 = IJ + 1
      IF (K3(IJ5)) 706,714,706
  706 IF (IJ6) 708,707,708
  707 IJ6 = I
      GO TO 709
  708 IJ6 = IJ7
  709 IJ7 = IJ
      BCD2 = BCD
      IJ1 = IJ4
      BCD = R(IJ4)
      IJ12 = 1
      GO TO 720
  710 IJ5 = IJ + 1
      IF (K3(IJ5)) 720,715,720
  720 CONTINUE
  714 IJ1 = IJ4
  715 JJJ = JJJ + 1
      IF (K1(IJ1)) 721,721,722
  721 K2(JJJ) = 0
      GO TO 723
  722 K2(JJJ) = IJ1
  723 IF (IJ1 - K3(IJ3)) 765,766,1090
  766 K3(IJ3) = 0
      IJ3 = IJ3 - 1
      GO TO 767
  765 DO 1080 IJ10 = IJ7,IJ3
      IJ11 = IJ10 + 1
```

```
1080 K3(IJ10) = K3(IJ11)
     IJ3 = IJ10 - 1
 767 IF (K3(2)) 1096,1096,1091
1096 JJJ = JJJ + 1
     K2(JJJ) = K3(1)
     GO TO 1090
1091 IF (IJ12) 699,699,702
 702 BCD = BCD2
     IJ12 = 0
     IJ2 = IJ7 - 1
     IJ7 = IJ6
     IJ1 = K3(IJ6)
     GO TO 701
 700 CONTINUE
*
*         CORRELATION COEFFICIENTS ARE PRINTED
*
1001 FORMAT ('  KNUM  COR. COEF.    KNUM  COR. COEF.    KNUM  COR. COEF.'%
     '     KNUM  COR. COEF.    KNUM  COR. COEF.    KNUM  COR. COEF.')
1090 I5 = 0
     DO 550 I = 1,I4
     IF (K2(I)) 550,550,549
 549 J = K2(I)
     K3(I) = K1(J)
     BCCD(I) = R(J)
     I5 = I5 + 1
 550 CONTINUE
     I4 = I5
 552 J1 = 1
     J5 = 6
     I3 = I4/6 + 1
 801 FORMAT (I2)
1191 WRITE (6,1001)
     DO 350 I = 1,I3
     WRITE (6,1002) (K3(J),BCCD(J),J=J1,J5)
     J1 = J1 + 6
 350 J5 = J5 + 6
     GO TO 360
 360 CONTINUE
     WRITE (6,1061)
```

```
1061 FORMAT (' DO YOU WANT TO RUN AGAIN? 00-NO, 01-YES')
     READ (5,801) JAKE
     IF (JAKE) 962,962,960
 962 CONTINUE
1911 FORMAT (2I4)
1912 FORMAT (2I5)
1913 FORMAT (2I6)
1914 FORMAT (I7)
1915 FORMAT (7X,2I4)
1916 FORMAT ('  DO YOU WANT TO DO WEATHERED SAMPLES OF OIL ONLY? 01-YES,00-NO')
1002 FORMAT (6(I7,2X,F7.5,4X))
1917 FORMAT ('  KNUM  COR. COEF.')
     END
```

APPENDIX IV. PUBLICATIONS AND PAPERS PRESENTED AT MEETINGS

Publications:

1. "Sampling of Oil Spills and Fingerprinting by Infrared Spectroscopy," C. W. Brown, M. Ahmadjian and P. F. Lynch, NBS Spec. Publ. 409, Marine Pollution Monitoring (1974), pp.91-92.

2. "Application of Cryogenic Infrared Spectroscopy to Identification of Petroleum," C. W. Brown, P. R. Lynch and S.-y. Tang, Anal. Chem., 47, 1696 (1975).

3. "Weathered Petroleum - Advantages of Using Infrared Spectroscopy for Identification," C. W. Brown, P. F. Lynch, M. Ahmadjian, and C. D. Baer, American Lab., 7, (12), 59 (1975).

4. "A Simple Technique for Removing Water from Weathered Petroleum," C. W. Brown, M. Ahmadjian, C. D. Baer, V. M. Westervelt, D. F. Grant and A. P. Bentz, Anal. Chem., 48, 628 (1976).

5. "Infrared Analysis of Weathered Petroleum Using Vacuum Techniques," C. W. Brown, and P. F. Lynch, Anal. Chem., 48, 191 (1976).

6. "Infrared Spectra of Petroleum Weathered Naturally and Under Simulated Conditions," C. W. Brown, M. Ahmadjian, C. D. Baer, and P. F. Lynch, Environ. Sci. Technol., July (1976).

7. "Matching Infrared Spectra of Weathered Petroleum by Correlation Coefficients," C. W. Brown, and C. D. Baer, in preparation.

8. "Weathered Petroleum - Probability of Identification by Infrared Spectroscopy," C. W. Brown, P. F. Lynch, and M. Ahmadjian, Anal. Chem., submitted for publication.

Papers at Meetings:

1. "Fingerprinting Petroleum Samples by Infrared Spectroscopy," C. W. Brown, P. F. Lynch, and M. Ahmadjian, 25th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Sym. on Fingerprinting Oil Spills) March 4-8, 1974.

2. "Techniques for Sampling Weathered Petroleum Products and for Measuring Their Infrared Spectra," P. F. Lynch, M. Ahmadjian, and C. W. Brown, ibid.

3. "Sampling of Oil Spills and Fingerprinting by Infrared Spectroscopy," C. W. Brown, M. Ahmadjian, and P. F. Lynch, Marine Pollution Monitoring (Petroleum) Symposium and Workshop, National Bureau of Standards, May 13-17, 1974.

4. "Infrared Spectroscopic Identification of Oils on Water," A. P. Bentz and C. W. Brown, Residuals in Waters Workshop, University of Connecticut, June 27-28, 1974.

5. "Identification of the Source of Oil by Infrared Spectroscopy," C. W. Brown, N.S.F. Workshop on "Analytical Needs of the Future as Applied to Coal Liquefaction," Greenbo Lake, Kentucky, August 21-23, 1974.

6. "Tracing the Source of Oil Slicks by Infrared Spectroscopy," C. W. Brown, 1974 Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, Atlantic City, Nov. 18-22, 1974.

7. "Low Temperature Studies of Petroleum Products," P. F. Lynch, S.-y. Tang, and C. W. Brown, ibid.

8. "Experimental Conditions for Matching Laboratory and Marine Weathering of Petroleum by Infrared Spectroscopy," M. Ahmadjian, C. D. Baer, P. F. Lynch, and C. W. Brown, 26th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Cleveland, March 1975.

9. "Identifying Oil in the Environment by Infrared Spectroscopy," C. W. Brown, American Chemical Society Meeting, Symposium on Energy and the Environment, Philadelphia, April, 1975.

10. "Advantages of Using Infrared Spectroscopy in Oil Identification," C. W. Brown, U. S. Coast Guard Seminar on Infrared Pattern Recognition, Groton, Connecticut, May 6, 1975.

11. "Infrared Spectra of Weathered Petroleum; Identification by Computer Analysis," C. D. Baer, M. Ahmadjian and C. W. Brown, ibid.

12. "Infrared Analysis of Weathered Petroleum Samples Using Vacuum Techniques," P. F. Lynch and C. W. Brown, ibid.

13. "Weathered Petroleum - Probability of Identification by Infrared Spectroscopy," C. W. Brown, M. Ahmadjian, and P. F. Lynch, 27th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Cleveland, March, 1976.

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